

**Vikram Kapila, Ph.D.**

**Professor**

**Department of Mechanical and Aerospace Engineering  
Mechatronics, Controls, and Robotics Laboratory (MCRL)**

**NYU Tandon School of Engineering (NYU Tandon)**

**Brooklyn, NY 11201**

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**Dr. Vikram Kapila****Professor of Mechanical Engineering**URL: <http://engineering.nyu.edu/mechatronics/>**Work:**

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**CAREER SUMMARY:**

- Developed an externally funded research, education, mentoring, and outreach program with over **20.3 million dollars** of funding, which includes over **10 million dollars** in National Science Foundation (NSF) grants as the Principal Investigator (PI).
- **250 scholarly publications:** Edited 3 books and published 10 chapters in edited books, 1 book review, 67 journal articles, and 169 conference papers. Citation statistics (Google Scholar)—Citations: 4600+, h-index: 31.
- Led the creation of a new degree program **M.S. in Mechatronics and Robotics**.
- Inaugural Director of the Ph.D. Professional Development Program at NYU Tandon (January 2020—current).
- Led the creation and planning for a **Tuition-based K-12 STEM Education** summer program (with \$120K+ revenue in first year and \$300K+ revenue in second year of operation).
- Extensive knowledge of and experience in **institutional shared governance** structures and **administrative procedures** through service on the institutional *Tenure and Promotion Committee* (three years as the Chair), *Faculty Executive Committee* (two years as the Speaker of The Faculty), *Financial Policies Committee*, and search committees for administrative leadership (President, Provost, Dean, etc.).
- Graduated 1 B.S., 45 M.S., and 10 Ph.D. students. Mentored 6 postdoctoral researchers. Currently mentoring 4 Ph.D. students, 10 M.S. students, and one research associate.
- Mentored 64 undergraduate research students and 11 undergraduate senior design project teams; over 500 K-12 teachers and 130 high school student researchers; and 18 undergraduate GK-12 STEM Fellows and 59 graduate GK-12 STEM Fellows.
- Direct K-12 education, training, mentoring, and outreach programs that currently enrich the STEM education of over 1,000 students annually.

**CITIZENSHIP:** U.S. Citizen.**RESEARCH INTERESTS:** Research @ the **convergence of frontier technologies** (robotics, artificial intelligence, augmented/virtual-reality, blockchain technology, etc.) with applications to

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<sup>1</sup> Formerly known as Brooklyn Polytechnic, Polytechnic University, Polytechnic Institute of NYU (NYU-Poly), and NYU Polytechnic School of Engineering (NYU-SoE).

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human-robot interaction, digital health, and STEM education. Other research interests include: mechatronics; smart sensors; cooperative control; distributed spacecraft formation control; linear/nonlinear control with applications to robust control, saturation control, and time-delay systems; closed-loop input shaping; spacecraft attitude control; DSP/PC/microcontroller-based real-time control; and K-12 STEM education.

**TEACHING INTERESTS:** Statics, Dynamics, Mechanical Vibration, Measurement Systems, Automatic Control, Mechatronics, Advanced Mechatronics, Smart Systems, Robotics, Robots for Disability, Digital Control, Optimal Multivariable Feedback Control, Nonlinear Control, Robust Control, Instrumentation Laboratory, and Real-Time Control Laboratory.

## EDUCATION

**Ph.D.** Aerospace Engineering, Flight Mechanics and Control

Georgia Institute of Technology, Atlanta, GA, March 1996 (Advisor: Professor Wassim M. Haddad)

**Dissertation:** *Robust Fixed-Structure Control of Uncertain Systems with Input-Output Nonlinearities*

**M.S.** Mechanical Engineering, Dynamics and Control

Florida Institute of Technology, Melbourne, FL, March 1993 (Advisor: Professor Wassim M. Haddad)

**Thesis:** *Optimal Control and Estimation for Discrete-Time Periodic and Multirate Systems*

**B.Tech.** Production Engineering and Management

National Institute of Technology,<sup>2</sup> Calicut, India, October 1988

## PROFESSIONAL EXPERIENCE

***Department of Mechanical and Aerospace Engineering, New York University Tandon School of Engineering (NYU Tandon), Brooklyn, NY.***

Director, PhD Student Professional Development Program, NYU Tandon, January 2020—current.

Professor (Tenured) April 2011—Present, Associate Professor (Tenured) September 2002—April 2011, Assistant Professor (Tenure Track) September 1996—August 2002.

Senior Faculty Fellow of Polytechnic University's Othmer Institute for Interdisciplinary Studies (September 2004—August 2007).

- Perform externally funded research in control system technology, mechatronics, robotics, K-12 STEM education, etc.
- Supervise undergraduate and graduate student research (senior designs, M.S. theses, and Ph.D. dissertations).
- Develop and teach courses/laboratories in dynamic systems, control, and mechatronics.
- Perform service to professional society, department, and university for professional development and growth.

***School of Aerospace Engineering, Georgia Institute of Technology, Atlanta, GA.***

Research Associate, January 1996—August 1996, Adjunct Faculty, March 1996—June 1996, Teaching Assistant, January 1996—March 1996, and Graduate Research Assistant, January 1994—January 1996.

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<sup>2</sup> Formerly known as Calicut Regional Engineering College.

- Undergraduate instruction in *Vibrations*, *System Dynamics*, and *Flight Mechanics and Control Laboratory*.
- Developed computational tools for robust fixed-order control, Riccati equation-based and gradient-based approaches to mixed  $H_2/L_1$  controller synthesis, and fixed-order controllers for active cancellation of pressure oscillations in jet engine combustors.
- Conducted research to develop robust controller analysis and synthesis tools for uncertain systems. Research concentrated on developing absolute stability theories, reduced-order modeling, robust  $H_\infty$  stabilization, stable stabilization, robust control for systems with slowly time-varying uncertain real parameters, and actuator saturation control.

***Department of Mechanical Engineering, Florida Institute of Technology, Melbourne, FL.***

Graduate Teaching Assistant, September 1991—December 1993.

- Course instructor for *Statics*, *Dynamics*, and *Materials Laboratory*. Responsibilities included independent teaching of above courses including lecture preparation, laboratory experiments, examinations, and assignment of final grades.
- Conducted research to develop periodic and multirate control algorithms. Specifically, developed an approach for designing reduced-order models, estimators, and controllers for discrete-time linear periodic plants with applications to fixed-structure multirate estimation and control.

***Technical Services Group, Hindustan Wires Limited, Faridabad, India.***

Development Engineer, March 1990—May 1991.

- Developed ballpoint tips and liquid petroleum gas regulator manufacturing plants. Responsibilities included vendor development and procurement of jigs and fixtures, pressure casting dies, and various machines, e.g., deburring, polishing, oil centrifuge, ultrasonic cleaning and drying, electronic precision balance, special purpose pneumatic machines for drilling, threading, and assembly operations, die casting machine, and electric furnace.

***Production, Rajinder Pipes and Leasings Limited, Kanpur, India.***

Trainee Engineer, October 1989—February 1990.

- Developed production tools for electrical resistance welding tubes and supervised shift production.

***Machine Tools, Progressive Spark Systems Private Limited, Faridabad, India.***

Project Engineer, October 1988—September 1989.

- Developed machine tool hardware for electro-discharge machines (EDM) and CNC wire EDM. Responsibilities included vendor development and procurement of machine tool slides, drives, enclosures, and oil tank and organization of machine tool assembly operation.

**1. FELLOWSHIPS, GRANTS, AWARDS, AND CONTRACTS<sup>3</sup>**

<b>No.</b>	<b>Role</b>	<b>Agency</b>	<b>Project Title</b>	<b>Funding</b>	<b>Period</b>
1.	PI	NSF <sup>4</sup>	Mercy College Fellowship for Master Teachers in STEM. Subcontract. <sup>5</sup>	\$80,000	9/19–8/21
2.	Co-PI	NSF	Workshops for the Future of Mechatronic and Robotic Education. PI: N.L. Yagin, Co-PI: M. Gennert and J. Mynderse. <sup>6</sup>	\$49,957	8/18–7/20
3.	Co-PI	DoD <sup>7</sup>	A Pilot Trial of Remotely-Supervised transcranial Direct Current Stimulation (RS-tDCS) to Enhance Motor Learning in Progressive Multiple Sclerosis (MS). PI: L. Charvet, Co-PI: P. Raghavan.	\$112,132 <sup>8</sup>	9/17–9/20
4.	PI	ITAC <sup>9</sup>	Futureworks-Mechatronics and Robotics Awareness Workshop and Robotics Implementation Project. <sup>10</sup>	\$40,675	4/17-10/18
5.	PI	NSF	ITEST: Promoting Robotic Design and Entrepreneurship Experiences among Students and Teachers. Co-PIs: S. Borges Rajguru, C. Milne, J. Montclare, and O. Nov; Sen. Pers.: B. Esner, M. Iskander, and M. Porfiri.	\$1,039,315	9/16–8/19
6.	PI	NSF	RET Site in Mechatronics and Robotics with Entrepreneurship and Industry Experiences. Co-PI: S. Borges Rajguru; Sen. Pers.: W. Chen, E. Dressaire, B. Esner, J. Kim, O. Nov, and M. Porfiri.	\$600,000	6/16–5/19
7.	Fac. Adv.	VentureWell <sup>11</sup>	Smartphone Stroke Rehab. Co-Advisor: P. Raghavan; Student Mentees: A.R. Kumar, S.P. Krishnamoorthy, and Seda Bilaloglu.	\$27,500	6/16–12/19

<sup>3</sup> Funding amounts shown are exclusive of university cost sharing, if any.

<sup>4</sup> National Science Foundation.

<sup>5</sup> Subcontract from an NSF award to Mercy College, PI: A. Gunning, Co-PIs: M. Marrero, R. Haskew-Layton, M. Ben-Jacob, and E. Nitecki. \$1,457,887, August 2018–July 2024. V. Kapila – PI on NYU Tandon subcontract.

<sup>6</sup> N.L. Yagin (Southern Illinois University); M. Gennert (Worcester Polytechnic Institute) and J. Mynderse (Lawrence Technological University).

<sup>7</sup> Department of Defense.

<sup>8</sup> This funding amount is allocated to co-PI V. Kapila at NYU Tandon. PI Charvet and Co-PI Raghavan are research personnel at the NYU Langone medical Center with their own funding allocation.

<sup>9</sup> Industrial and Technology Assistance Corporation.

<sup>10</sup> Mechatronics and Robotics Awareness Workshop is supported by ITAC under a contract from NYC Economic Development Corporation (\$31,000). The Robotics Implementation project is supported by ITAC under a contract from a NYC manufacturer (\$9,675).

<sup>11</sup> VentureWell: 2016 BMEIdea Competition (Smartphone Integrated Stroke Rehabilitation; Co-Advisor: P. Raghavan; Student Mentees: A.R. Kumar and S.P. Krishnamoorthy. Our entry won the third prize in this national contest, 6/16). 2016 ETeam Competition (Telerehabilitative Solutions for Stroke Patients; Co-Advisor: P. Raghavan; Student Mentees: A.R. Kumar, Seda Bilaloglu, and S.P. Krishnamoorthy, 10/16–10/17).

No.	Role	Agency	Project Title	Funding	Period
8.	PI	NYC DoE <sup>12</sup>	Summer 2016 STEM Education Partnership Program. Co-Directors: V. Kapila and B. Esner.	\$351,510 <sup>13</sup>	3/16–11/16
9.	PI	NYC DoE	Robots, Microcontrollers & Computing for STEM Ed. Co-PIs: J. Listman and B. Esner.	\$31,785	2/16–5/17
10.	Fac. Adv.	Verizon <sup>14</sup>	Connecting People to Robots Using Interactive Augmented Reality Apps. Student Mentees: J.A. Frank and M. Moorhead.	\$25,000	2/16–6/16
11.	Fac. Part.	VentureWell	Course & Program Faculty Grant: Pre-Capstone Innovation Experience. PI: J. Montclare; V. Kapila one of nine faculty participant.	\$30,000	3/16–8/19
12.	PI	Multiple <sup>15</sup>	Friends of NYU Tandon Mechatronics and Robotics Program.	\$31,808 <sup>16</sup>	1/16–12/18
13.	PI	SFE <sup>17</sup>	Expanding the Center for K-12 STEM Education (Teacher Professional Development). Co-PI: B. Esner.	\$100,000	7/15–8/20
14.	PI	Con Edison	Underground Live End Cap Splicing Machine. Co-PI: S.H. Lee.	\$31,450	7/15–8/16
15.	PI	NYC DoE	Summer 2015 STEM Education Partnership Program. Co-Directors: V. Kapila and B. Esner.	\$939,429 <sup>18</sup>	2/15–9/15
16.	PI	NSF	DR K-12: Teaching STEM with Robotics: Design, Development, and Testing of a Research-based Professional Development Program for Teachers. Co-PIs: M. Iskander, C. Milne, and J. Ma; Sen. Pers.: B. Esner.	\$2,545,955 <sup>19</sup>	9/14–8/18

<sup>12</sup> New York City, Department of Education.

<sup>13</sup> The Fund for Public Schools: \$351,510.

<sup>14</sup> Verizon Open Innovation Challenge, 2015–2016. Our entry in the contest was one of 14 winners.

<sup>15</sup> Quanser, National Instruments, Dassault Systemes, Operant Systems, and an individual contributor.

<sup>16</sup> Quanser: In addition to \$5,000 annual cash contribution for three years, Quanser has committed \$15,000 annual equipment donation for three years, and \$10,000 in-kind support for equipment refurbishment. Bringing total cash, equipment, and in-kind support to \$70,000. For a Mechatronics Education Innovation Workshop at NYU Tandon (November’16), following contributions were received: Quanser—\$3,200, National Instruments—\$1,000, and Dassault Systemes—\$1,000. Travel support for Mechatronics 4.0 Workshop in Denmark—\$2,208 (Quanser). Operant Systems: \$5,275 and one individual contribution: \$4,125. Only cash contributions are reported.

<sup>17</sup> Siegel Family Endowment: \$100,000 (7/2015).

<sup>18</sup> NYC DoE: \$463,998 and The Fund for Public Schools: \$475,431. The sponsors (NYC DoE and The Fund for Public Schools) received \$500,000 from the Microsoft Corporation in support of this effort.

<sup>19</sup> Continuing grant with Y1–Y4 funding \$2,545,955 awarded.

<b>No.</b>	<b>Role</b>	<b>Agency</b>	<b>Project Title</b>	<b>Funding</b>	<b>Period</b>
17.	Sen. Pers.	NSF	RET Site: Research Experience and Training in Cyber Security for Pre-College Teachers. PI: N. Memon, 1 Co-PI, 2 Senior Personnel.	\$500,000	4/14-3/17
18.	Sen. Pers.	NSF	Building Cyber Security Capacity in Two-Year and Four-Year Colleges. PI: N. Memon, 3 Co-PIs, 1 Senior Personnel.	\$871,763	9/12-8/15
19.	PI	NSF	Mercy Intensive STEM Teacher Initiative (MISTI)—Subcontract. <sup>20</sup>	\$20,075	1/14—12/18
20.	PI	NSF	RET Site: Science and Mechatronics Aided Research for Teachers with an Entrepreneurship experience (SMARTER). 6 Senior Personnel.	\$530,537 <sup>21</sup>	5/12—4/16
21.	Co-PI	NSF	Building Cyber Security Capacity by Means of a National High School Digital Forensics Challenge. PI: N. Memon, Co-PI: R. Karri.	\$299,901	9/11—8/13
22.	Co-Dir.	Multiple <sup>22</sup>	Applied Research in Science and Engineering (ARISE): Summer Research Program for High School Students. Co-Directors: B. Esner, V. Kapila, and M. Iskander.	\$1,797,272	1/13—12/19
23.	Co-Dir.	Multiple <sup>23</sup>	Robotics, Mechatronics, Smart Cities Informal Education. Co-Dir. B. Esner.	\$590,391	7/11—6/18

<sup>20</sup> Subcontract from an NSF award to Mercy College: M. Marrero, A. Canger, W. Farber, A., Gunning, and M. Ben-Jacob, \$803,825, January 2014. V. Kapila – PI on NYU Tandon subcontract.

<sup>21</sup> Continuing award with annual funding \$162,499 for three-year project duration. \$3,040 supplement award (7/14) for an NSF workshop. \$40,000 supplement award (8/16) for a Mechatronics Education Innovation Workshop.

<sup>22</sup> Pinkerton Foundation: \$399,762 (2013), \$105,000 (2014); \$160,000 (2015); \$160,000 (2016); \$812,510 (2017—2019) and Driskill Foundation: \$160,000 (2015).

<sup>23</sup> Brooklyn Prospect Charter School: Robotics Instruction and Professional Development, \$46,095 (2016), \$17066 (2017).

Wallerstein Collaborative for Urban Environmental Education at NYU Steinhardt (SYSTEM Project): \$8,500, (2011) and \$8,500, (2012) “Environmental Mechatronics Summer Project.”

Groundwork Inc.: \$15,230 (2011), “LEGO Robotics Summer Camp.”

Daniel and Joanna Rose Foundation: \$115,000 (2012), “STEM Program for Harlem Educational Activities Fund (HEAF) Students.” Proposal submitted by Ms. Barbara Noseworthy, V.P. for Development and Alumni Relations, who worked with the project team to develop the proposal (\$115,000 is part of a larger \$600,000 award to NYU-Poly).

Philanthropic Donor (E. Berman): \$75,000 (2012), “Science of Smart Cities Curriculum Dissemination—Curriculum Revision and Creation/Implementation of Training Program,” B. Esner (PI), V. Kapila (Faculty Advisor).

New York City FIRST: \$100,000 (2013), “FIRST Academy Pilot,” B. Esner (PI), V. Kapila (Faculty Advisor).

National University of Malaysia: \$205,000 (2013), “Pesta Bitara STEM,” B. Esner (PI), V. Kapila, M. Iskander, and M. Porfiri (Faculty Advisors).

<b>No.</b>	<b>Role</b>	<b>Agency</b>	<b>Project Title</b>	<b>Funding</b>	<b>Period</b>
24.	PI	Multiple <sup>24</sup>	Central Brooklyn STEM Initiative (CBSI). Co-PIs: B. Esner and M. Iskander.	\$1,854,920	7/10-6/16
25.	PI	NSF	RET Site: Science and Mechatronics Aided Research for Teachers (SMART). Senior Personnel: N. Gupta, M. Iskander, and M. Porfiri.	\$517,000 <sup>25</sup>	1/09–12/11
26.	PI	NSF	New, GK12: Applying Mechatronics to Promote Science (AMPS). Co-PIs: M. Iskander and B. Esner <sup>26</sup> ; Sen. Per.: D. Czarkowski, R. Levicky, and M. Porfiri.	\$3,000,000 <sup>27</sup>	6/08–5/13
27.	Co-Dir.	NYC DoE	Applied Science and Technology Institute. N. Kriftcher (Co-Director)	\$142,416 <sup>28</sup>	5/08–6/09
28.	PI	Multiple <sup>29</sup>	Central Brooklyn Robotics Initiative (CBRI). Co-PIs: N. Kriftcher and M. Iskander. <sup>30</sup>	\$580,700	7/07–8/11
29.	PI	NYSED <sup>31</sup>	Summer Mechatronics Institute for Teachers (SUMMIT). N. Kriftcher (Co-PI).	\$240,654	5/07–10/07

<sup>24</sup> Brooklyn Community Foundation (BCF): \$500,000 (2010). Formerly Independence Community Foundation (ICF).

Black Male Donor Collaborative (BMDC): \$100,000 (2010) and \$100,000 (2012). Second proposal submitted by Ms. J. Cho, Senior Development Officer, who worked with the project team to develop the proposal.

Motorola Innovation Generation Grant: \$50,700 (2010). Proposal submitted by Mr. K. Hervas, Associate Director of Corporate and Foundation Relations, who worked with the project team to develop the proposal.

New York Space Grant Consortium: \$10,000 (2010). “Broadening Female Students’ Doctoral Training via a Synergistic Program in STEM Research and Mechatronics/Robotics K–12 Outreach.”

Xerox Foundation: \$300,000 (2011). Proposal submitted by Mr. K. Hervas, who worked with the project team to develop the proposal. \$400,000 (2014). Proposal submitted by Mr. M. Corrente, who worked with the project team to develop the proposal.

White Cedar Fund: \$75,000 (2011). \$25,000 (2014).

J.P. Morgan Chase Foundation: \$75,000 (2011), \$75,000 (2012), \$50,000 (2013), \$50,000 (2014).

FAR Fund: \$44,220, 9/14–8/15, (through the NYU Steinhardt Occupational Therapy Department for placing an AMPS/CBSI GK-12 Fellow at the Brooklyn Millennium HS).

<sup>25</sup> Continuing award with annual funding \$166,667 for three-year project duration. Supplemental awards: \$12,000 (4/12) for the Second USA Science and Engineering Festival and \$5,000 (11/10) for the TRE Conference.

<sup>26</sup> N. Kriftcher, originally a Co-PI, retired on 11/10 and B. Esner replaced N. Kriftcher on 3/11.

<sup>27</sup> Continuing award with annual funding \$600,000 for five-year project duration.

<sup>28</sup> New York City Department of Education: Community School District 24—\$71,208 and Community School District 32—\$71,208.

<sup>29</sup> ICF: \$125,000 (2008) and \$175,000 (2007).

J.P. Morgan Chase Foundation: \$50,000 (2010), \$60,000 (2008), and \$50,000 (2007).

Motorola Innovation Generation Grant: \$50,700 (2009) and \$50,000 (2008). Proposal submitted by Mr. K. Hervas, who worked with the project team to develop the proposal.

NASA/New York Space Grant Consortium: \$20,000 (2008); “Supporting Doctoral Engineering Pipeline via a Synergistic Program in Mechatronics/Robotics Research and K-12 Outreach.”

<sup>30</sup> M. Iskander joined as a Co-PI in July 2008. V. Kapila and N. Kriftcher serve as Co-Directors.

<sup>31</sup> New York State Education Department—Engineers of the Future Program.



No.	Role	Agency	Project Title	Funding	Period
30.	Co-PI	NYSED	Summer Workshop in Instrumentation, Sensors and Engineering (WISE). M. Iskander (PI) and N. Kriftcher (Co-PI).	\$297,455	5/07–10/07
31.	PI	NYC DoE	Research Experience for Teachers in Mechatronics: Multiple Projects <sup>32</sup>	\$126,000	7/05–8/06
32.	PI	NASA–NYC <sup>33</sup>	Mechatronics Mentoring for NASA SHARP Students	\$5,000	6/05–8/05
33.	SFF <sup>34</sup>	OIIS <sup>35</sup>	Senior Faculty Fellow Award	\$45,000	9/04–8/07
34.	PI	NSF	Revitalizing Achievement by using Instrumentation in Science Education (RAISE). Co-PIs: M. Iskander and N. Kriftcher.	\$1,514,762 <sup>36</sup>	6/04–6/07
35.	PI	NASA <sup>37</sup>	Architectures and Algorithms for Distributed Spacecraft Formation Control	\$72,000	9/03–8/06
36.	PI	NSF	Research Experience for Teachers Site in Mechatronics	\$450,000	1/03–12/05
37.	PI	NYU <sup>38</sup>	Teaching/Education: Multiple Awards/ Grants <sup>39</sup>	\$65,000	4/15, 5/14, 5/11, 5/08, and 10/02–6/03

<sup>32</sup> *i*) Subcontract under a Title IIB Math Science Partnership Grant to the Community School District 21, Region 7, and NYU-Poly’s Packard Center, \$105,000 (2005); *ii*) Subcontract under a \$300,000 VATEA Grant to the Midwood High School to establish a four-year Robotics Academy, assisted with Curriculum/Program Development, \$6,000, (2005); and *iii*) from the New York City Museum School, \$15,000 (2004).

<sup>33</sup> National Aeronautics and Space Administration, New York City Research Initiative, subcontract from the City University of New York.

<sup>34</sup> Senior Faculty Fellow.

<sup>35</sup> Othmer Institute for Interdisciplinary Studies @ Polytechnic University.

<sup>36</sup> NSF: \$1,474,762 (2004), ICF: \$25,000 (2007), and Hebrew Technical Institute (HTI): \$15,000 (2007). Proposals to ICF and HTI submitted by Mr. K. Hervas, who worked with the project team to develop the proposal.

<sup>37</sup> National Aeronautics and Space Administration—Goddard Space Flight Center.

<sup>38</sup> NYU Tandon SoE or its predecessors NYU-Poly and Polytechnic University.

<sup>39</sup> *i*) a 2015 NYU Distinguished Teaching Award—Dr. Kapila was nominated as a candidate for the award by an *ad hoc* committee of NYU-SoE faculty, \$5,000 (4/15); *ii*) a 2014 *Jacobs Excellence in Education Award* at NYU-SoE for being “a dedicated educator” whose “commitment to scholarship and teaching is widely recognized,” \$10,000 (5/14); *iii*) a 2011 *Jacobs Excellence in Education Award* at NYU-Poly for “pioneering programs to promote K-12 STEM education and receiving national recognition through an Outstanding Project Award from the National Science Foundation,” \$10,000 (5/11); *iv*) a 2008 *Jacobs Excellence in Education Award* at NYU-Poly for “creating several nationally recognized programs to promote interest among elementary, junior high, and high school students in science, technology, engineering and mathematics (STEM),” \$10,000 (5/08); *v*) The 2003 *Distinguished Teacher Award* at Polytechnic University, \$10,000 (6/03); *vi*) a 2002 *Jacobs Innovation Grant* at Polytechnic University to develop “A Toolkit for Mechatronics Projects,” \$10,000 (12/02); and *vii*) a 2002 *Jacobs Excellence in Education Award* at Polytechnic University for “demonstrated educational innovation and excellence in creating an internationally recognized web-based control laboratory funded by a National Science Foundation grant,” \$10,000 (10/02).

<b>No.</b>	<b>Role</b>	<b>Agency</b>	<b>Project Title</b>	<b>Funding</b>	<b>Period</b>
38.	PI	NASA	Algorithms and Architectures for Control of Distributed Spacecraft Formations	\$62,895	10/01–9/02
39.	PI	AFRL <sup>40</sup>	Control Algorithms for Cooperative Control of Spacecraft Formations	\$44,378	6/01–8/01
40.	PI	ORI <sup>41</sup>	Multi-Vehicle Coordination: Multiple Grants <sup>42</sup>	\$111,000	6/00–5/04
41.	PI	NYSGC <sup>43</sup>	Applications of Internet-based Real-Time Control in Mechatronics Oriented Projects <sup>44</sup>	\$360,910	2/00–4/19
42.	PI	ASME <sup>45</sup>	Real-Time Experimental Control Workshops	\$10,000	9/99–8/01
43.	Co-PI	NSF	Development of A Remote Access Internet Based Mechatronics/Process Control Laboratory. PI: A. Tzes. <sup>46</sup>	\$99,998	7/99–12/01
44.	PI	AFRL	Advanced Control of Formation Flying Spacecraft	\$38,336	6/99–08/99
45.	PI	AFOSR <sup>47</sup>	Dynamics and Control of Spacecraft Formation Flying	\$25,000	1/99–12/99
46.	PI	ASHRAE <sup>48</sup>	Instrumentation Support: Multiple Projects <sup>49</sup>	\$10,000	8/98–8/00

<sup>40</sup> Air Force Research Laboratory (AFRL), Dayton, OH.

<sup>41</sup> Orbital Research Inc., Cleveland, OH.

<sup>42</sup> *i*) Swarm Intelligence and Command Interface for Collective Operation of Military UAV Teams: UAV Path Planning, \$87,000 (2002), Air Force; *ii*) Decentralized Hybrid Control Strategies for Autonomous Multi-Agent Swarms: Multi-Agent Task Assignment, \$5,000 (2002), Army; *iii*) Multi-Vehicle Coordination, \$9,500 (2001), Air Force; and *iv*) Dynamics, Control, and Relative Trajectory Generation for Multiple Spacecraft Formation Flying, \$9,500 (2000), Air Force.

<sup>43</sup> New York Space Grant Consortium—NASA.

<sup>44</sup> Contract annually reviewed for renewal with typical annual budget \$15,000. Control of Aerospace Systems, Mechatronics, and K–12 Outreach \$20,000/year (4/16–4/19) and \$15,000/year (2/05–3/16); Applications of Internet-based Real-Time Control in Mechatronics Oriented Projects \$15,000/year (2/00–1/05); and supplement awards: *i*) A Workshop to Disseminate LEGO Mindstorms-based Science and Math Lessons to K-12 Teachers, \$5,500 (2012); *ii*) Student internship, \$5,500 (2008); *iii*) Mechatronics Outreach to Pre-College Teachers, \$5,000 (2006); *iv*) A Professional Development Workshop for High School Science Teachers, \$12,410 (2004); *v*) 3 Undergraduate Summer Internships under a Workforce Development Program, \$14,700 (2003); and *vi*) Real-Time Experimental Control Workshop, \$2,800 (2000).

<sup>45</sup> American Society of Mechanical Engineering—Dynamic System and Control Division (ASME—DSCD).

<sup>46</sup> Professor Tzes began an extended leave of absence from Poly in fall 1999. He is now with the University of Patras, Greece.

<sup>47</sup> Air Force Office of Scientific Research.

<sup>48</sup> American Society of Heating, Refrigeration, and Air Conditioning Engineers.

<sup>49</sup> *i*) Advanced Control Design for Active Noise Cancellation in HVAC-Ducts, \$5,000 (1999) and *ii*) Advanced Control Design for Off-Peak Ice Generation/Storage and Air Conditioning System, \$5,000 (1998).

<b>No.</b>	<b>Role</b>	<b>Agency</b>	<b>Project Title</b>	<b>Funding</b>	<b>Period</b>
47.	PI	NYSGC	Applications of Remote-Access in Mechatronics Oriented Senior Projects. Co-PIs A. Tzes and S. Kumar.	\$30,000	2/98–01/00
48.	Faculty Associate	AFRL	Spacecraft Formation Flying	\$10,000	6/98–7/98

**Total Funding: \$20,359,949**

## 2. SCHOLARLY WORK

### A. Edited Books and Book Chapters:

1. I.F.J. Ghalyan, Z.M. Abouelenin, G. Annamalai, and **V. Kapila**, “Gaussian Smoothing Filter for Improved EMG Signal Modeling,” in I. Obeid, et al. (eds.), *Signal Processing in Medicine and Biology: Emerging Trends in Research and Applications*, Springer International Publishing AG, 161–204, 2020.
2. J.A. Frank. A. Brill, **V. Kapila**, “Mobile Cyber-Physical Labs: Integration of Mobile Devices with System and Control Laboratories,” in M.E. Auer et al. (eds.), *Cyber-Physical Laboratories in Engineering and Science Education*, Springer International Publishing AG, 403–434, 2018.
3. J.A. Frank and **V. Kapila**, “Integrating Smart Mobile Devices for Immersive Interaction and Control of Physical Systems: A Cyber-Physical Approach,” *Advanced Mechatronics and MEMS Devices II*, (D. Zhang and B. Wei, Eds.), 73–93, Switzerland: Springer, 2017.
4. D. Levey, **V. Kapila**, P. Marsteller, and A. Altman Mitchell, “Sustainability and Sources of Funding,” in *The Power of Partnerships: A Guide from the NSF Graduate STEM Fellows in K–12 Education Program*, K. Stoll, S. Ortega, and T. Spuck (Eds.), 107–117. Washington, DC: American Association for the Advancement of Science, 2013, ISBN: 978-0-87168-754-8.
5. C. Dubey and **V. Kapila**, “Detection and Characterization of Cracks in Beams via Chaotic Excitation and Statistical Analysis,” in *Application of Chaos and Nonlinear Dynamics in Engineering*, S. Banerjee, M. Mitra, and L. Rondoni (Eds.), 137–164. Berlin: Springer-Verlag, 2011, ISBN-10: 3642219217.
6. C. Dubey, H. Wong, **V. Kapila**, and P. Kumar, “Web-Enabled Remote Control Laboratory Using an Embedded Ethernet Microcontroller,” in *Internet Accessible Remote Laboratories: Scalable E-learning Tools for Engineering and Science Disciplines*, A.K.M. Azad, M.E. Auer, and V.J. Harward (Eds.), 338–361, IGI Global, USA, 2011, DOI: 10.4018/978-1-61350-186-3.
7. K. Elleithy, T. Sobh, M. Iskander, and **V. Kapila** (Eds.), *Technological Developments in Networking, Education and Automation*, Springer, (ISBN: 978-90-481-9150-5), 2010.
8. M. Iskander, **V. Kapila**, and M. A. Karim (Eds.), *Technological Developments in Education and Automation*, Springer, (ISBN: 978-90-481-3655-1), 2010.
9. H. Wong, H. Pan, M.S. de Queiroz, and **V. Kapila**, “Adaptive Learning Control for Spacecraft Formation Flying,” in *Advances in Dynamics and Control*, S. Sivasundaram, (Ed.), Chapman and Hall/CRC, Boca Raton, FL, 15–27, 2004.
10. **V. Kapila** and K. Grigoriadis (Eds.), *Actuator Saturation Control*, Marcel Dekker, Inc., New York, NY, (ISBN: 0-8247-0751-6), 2002.
11. H. Pan and **V. Kapila**, “LMI-based Control of Discrete-Time Systems with Actuator Amplitude and Rate Nonlinearities,” in *Actuator Saturation Control*, V. Kapila and K. Grigoriadis (Eds.), Marcel Dekker, Inc., New York, NY, 135–162, 2002.
12. W. M. Haddad, **V. Kapila**, and C.T. Abdallah, “Stabilization of Linear and Nonlinear Systems with Time Delay,” in *Stability and Control of Time-Delay Systems*, L. Dugard and E. Verriest (Eds.), Springer, 205–217, 1997.
13. W. M. Haddad and **V. Kapila**, “A Periodic Fixed-Architecture Approach to Multirate Digital Control Design,” in *Control and Dynamic Systems: Advances in Theory and Applications*, C. T. Leondes (Ed.), Academic Press, Vol. 78, 183–228, 1996.

**B. Books Review:**

1. **V. Kapila**, “Mechatronic Systems Fundamentals by Rolf Isermann,” *IEEE Control Systems Magazine*, Vol. 25, 73–77, 2005.

**C. Editorial Activities:**

1. Member, International Program Committee, *International Conference on Informatics in Control, Automation and Robotics*, France, July’15 and Lisbon, Portugal, July’16.
2. Member, International Program Committee, *Indian Control Conference*, Chennai, India, January’15; Hyderabad, India, January’16; and Guwahati, India, January’17.
3. Member, Editorial Board, *International Journal of Online Engineering*, January 2012–December 2018.
4. Corresponding Editor for New Products, *IEEE Control Systems Magazine*, August 2005–February 2008. Responsible for New Product Announcements, New Product Review Articles, and New Product Spotlight Columns.

**D. Refereed Journal Articles:**

1. H.S. You, S.M. Chacko, and **V. Kapila**, “Examining the Effectiveness of a Professional Development Program: Integration of Educational Robotics into Science and Mathematics Curricula,” *Journal of Science Education and Technology*. To appear.
2. H.K. Wazir, C. Lourido, S.M. Chacko, and **V. Kapila**, “A COVID-19 Emergency response for Remote Control of A Dialysis Machine with Mobile HRI,” *Frontiers in Robotics and AI* (Biomedical Robotics: Robotics, Autonomous Systems and AI for Nonurgent/Nonemergent Healthcare Delivery During and After the COVID-19 Pandemic). To appear.
3. V. Jayasree-Krishnan, S. Ghosh, A. Palumbo, **V. Kapila**, and P. Raghavan, “Developing A Framework for Designing and Deploying Technology-Assisted Rehabilitation Post Stroke: A Qualitative Study,” *American Journal of Physical Medicine and Rehabilitation*, 2020. <https://doi.org/10.1097/PHM.0000000000001634>.
4. A. RajKumar, F. Vulpi, S.R. Bethi, P. Raghavan, and **V. Kapila**, “Usability Study of Wearable Inertial Sensors for Exergames (WISE) for Movement Assessment and Exercise,” *mHealth*, 2020. <http://mhealth.amegroups.com/article/view/44478>.
5. A. RajKumar, F. Vulpi, S.R. Bethi, H.K. Wazir, P. Raghavan, and **V. Kapila**, “Wearable Inertial Sensors for Range of Motion Assessment,” *IEEE Sensors Journal*, Vol. 20, No. 7, 3777-3787, 2020. DOI: 10.1109/JSEN.2019.2960320.
6. I.F.J. Ghalyan, S.M. Chacko, and **V. Kapila**, “Simultaneous Robustness against Random Initialization and Optimal Order Selection in Bag-of-Words Modeling,” *Pattern Recognition Letters*, Vol. 116, 135–142, 2018. DOI: 10.1016/j.patrec.2018.09.010.
7. J.A. Frank, S. Krishnamoorthy, and **V. Kapila**, “Toward Mobile Mixed-Reality Interaction With Multi-Robot Systems,” *IEEE Robotics and Automation Letters*, Vol. 2, No. 4, 1901–1908, 2017.
8. J.A. Frank, M. Moorhead, and **V. Kapila**, “Mobile Mixed-Reality Interfaces that Enhance Human-Robot Interaction in Shared Spaces,” *Frontiers in AI and Robotics*, June 2017, Vol. 4, Article 20.

9. R.G. Yadagiri, S. Krishnamoorthy, and **V. Kapila**, “A Blocks-based Visual Environment to Teach Robot-Programming to K-12 Students,” *ASEE Computers in Education Journal*, Vol. 8, No. 2, 24–32, 2017.
10. J.A. Frank and **V. Kapila**, “Mixed-reality Learning Environments: Integrating Mobile Interfaces with Laboratory Test-beds,” *Computers & Education*, 2017. <http://dx.doi.org/10.1016/j.compedu.2017.02.009>. (16 pages).
11. J.A. Frank, A. Brill, and **V. Kapila**, “Mounted Smartphones as Measurement and Control Platforms for Motor-Based Laboratory Test-Beds,” *Sensors*, Vol. 16, 1331, 2016. DOI:10.3390/s16081331. (25 pages).
12. J.A. Frank and **V. Kapila**, “Using Mobile Devices for Mixed-Reality Interactions with Educational Laboratory Test-beds,” *ASME Dynamic Systems and Control*, Vol. 4, No. 2, 2–6, June 2016.
13. V. Siderskiy and **V. Kapila**, “Parameter Matching Using Adaptive Synchronization of Chua’s Circuit,” *International Journal of Bifurcation and Chaos*, Vol. 24, No. 11, 1430032 (28 pages), 2014.
14. J.A. Frank and **V. Kapila**, “Development of Mobile Interfaces to Interact with Automatic Control Experiments,” *IEEE Control Systems Magazine*, Vol. 34, No. 52, 78–98, 2014.
15. J. Laut, **V. Kapila**, and M. Iskander, “Exposing Middle School Students to Robotics and Engineering through LEGO and Matlab,” *ASEE Computers in Education Journal*, Vol. 5, No. 3, 2–13, 2014. **Received the 2014 Ray H. Spiess Award** given annually to the outstanding *ASEE CoED Journal* paper on mobile teaching aids and computation techniques.
16. **V. Kapila** and M. Iskander, “Lessons Learned from Conducting a K-12 Project to Revitalize Achievement by using Instrumentation in Science Education,” *Journal of STEM Education*, Vol. 15, No. 1, 46–51, 2014.
17. N. Abaid, J. Bernhardt, J. A. Frank, **V. Kapila**, D. Kimani, and M. Porfiri, “Controlling A Robotic Fish with A Smart Phone,” *Mechatronics*, Vol. 23, No. 5, 491–496, 2013.
18. E. Suescun-Florez, M. Iskander, **V. Kapila**, and R. Cain, “Geotechnical Engineering in US Elementary Schools,” *European Journal of Engineering Education*, Vol. 38, No. 3, 300–315, 2013.
19. E. Suescun-Florez, M. Iskander, R. Cain, and **V. Kapila**, “Elementary School Geotechnical Engineering,” *Geo-Strata*, 44–48, March-April 2013.
20. K. Williams, I. Igel, R. Poveda, **V. Kapila**, and M. Iskander, “Enriching K-12 Science and Mathematics Education Using LEGOs,” *Advances in Engineering Education*, Vol. 3, No. 2, summer 2012. See: <http://advances.asee.org/vol03/issue02/10.cfm>.
21. C. Dubey and **V. Kapila**, “Wave Fractal Dimension as a Tool in Detecting Cracks in Beam Structures,” *Chaotic Modeling and Simulation (CMSIM)*, Vol. 1, 241–256, 2012.
22. M. Iskander and **V. Kapila**, “Revitalizing Achievement by Using Instrumentation in Science Education (RAISE), A GK-12 Fellows Project,” *Journal of Professional Issues in Engineering Education and Practice*, Vol. 138, 62–72, 2012.
23. N. Abaid, C. Yuvienco, **V. Kapila**, and M. Iskander, “Mechatronics Mania at the Inaugural USA Science and Engineering Festival,” *IEEE Control Systems Magazine*, Vol. 31, 105–110, 124, 2011.
24. S.-H. Lee, **V. Kapila**, M. Porfiri, and A. Panda, “Master-Slave Synchronization of Continuously and Intermittently Coupled Sampled-Data Chaotic Oscillators,” *Communications in Nonlinear Science and Numerical Simulation*, Vol. 15, 4100–4113, 2010.

25. S.-H. Lee, A. Panda, **V. Kapila**, and H. Wong, "Development of a Matlab Data Acquisition and Control Toolbox for PIC Microcontrollers," *ASEE Computers in Education Journal*, Vol. I, 38–51, 2010.
26. I. Ahmed, H. Wong, and **V. Kapila**, "Internet-Based Remote Control using a Microcontroller and an Embedded Ethernet Board," *ASEE Computers in Education Journal*, Vol. I, 15–21, 2010.
27. M. Iskander, **V. Kapila**, and N. Kriftcher, "Outreach to K-12 Teachers: Workshop in Instrumentation, Sensors, and Engineering (WISE)," *ASCE Journal of Professional Issues in Engineering Education and Practice*, Vol. 136, 102–111, 2010.
28. M. Iskander, **V. Kapila**, and N. Kriftcher, "Using Modern Sensors in High School Science Labs to Promote Engineering Careers," *ASCE Advances in Analysis, Modeling, and Design*, GSP No. 199, 3295–3304, 2010.
29. A. Panda, H. Wong, **V. Kapila**, and S.-H. Lee, "Two-Tank Liquid Level Control Using a Basic Stamp Microcontroller and a Matlab-Based Data Acquisition and Control Toolbox," *ASEE Computers in Education Journal*, Vol. XVII, 32–46, 2007.
30. S. Sobhan, N. Yakubov, **V. Kapila**, M. Iskander, and N. Kriftcher, "Modern Sensing and Computerized Data Acquisition Technology in High School Physics Labs," *International Journal of Engineering Education*, Vol. 23, Part I, 902–909, 2007.
31. H. Wong and **V. Kapila**, "Internet-Based Remote Control of a DC Motor using an Embedded Ethernet Microcontroller," *ASEE Computers in Education Journal*, Vol. XV, 57–67, 2005.
32. S.-H. Lee, Y.-F. Li, and **V. Kapila**, "Development of a Matlab-Based Graphical User Interface Environment for PIC Microcontroller Projects," *ASEE Computers in Education Journal*, Vol. XV, 41–56, 2005.
33. H. Pan, H. Wong, **V. Kapila**, and M. S. de Queiroz "Experimental Validation of a Nonlinear Backstepping Liquid Level Controller for a State Coupled Two Tank System," *Control Engineering Practice*, Vol. 13, 27–40, 2005.
34. **V. Kapila** and S.H. Lee, "Science and Mechatronics Aided Research for Teachers," *IEEE Control Systems Magazine*, Vol. 24, 24–30, October 2004.
35. W. M. Haddad and **V. Kapila**, "Actuator Amplitude Saturation Control for Systems with Exogenous Disturbances," *Int. J. Sys. Science*, Vol. 33, 939–947, 2002.
36. H. Pan and **V. Kapila**, "Control of Discrete-Time Systems with Actuator Nonlinearities," *Int. J. Sys. Science*, Vol. 33, 777–788, 2002.
37. G. Yang, Q. Yang, **V. Kapila**, D. Palmer, and R. Vaidyanathan, "Fuel Optimal Maneuvers for Multiple Spacecraft Formation Reconfiguration using Multi-Agent Optimization," *Int. J. Robust and Nonlinear Contr.*, Vol. 12, 243–283, 2002.
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43. **V. Kapila**, A. Tzes, and Q. Yan, "Closed-Loop Input Shaping for Flexible Structures using Time-Delay Control," *ASME J. Dyn., Meas., and Contr.*, Vol. 122, 454–460, 2000.
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45. M. S. de Queiroz, **V. Kapila**, and Q. Yan, "Adaptive Nonlinear Control of Multiple Spacecraft Formation Flying," *AIAA J. Guid. Contr. Dyn.*, Vol. 23, 385–390, 2000.
46. **V. Kapila** and W. M. Haddad, "Fixed-Structure Controller Design for Systems with Actuator Amplitude and Rate Nonlinearities," *Int. J. Contr.*, Vol. 73, 520–530, 2000.
47. W. M. Haddad, A. Leonessa, J. Corado, and **V. Kapila**, "State Space Modeling and Robust Reduced-Order Control of Combustion Instabilities," *J. Franklin Inst.*, Vol. 336, 1283–1307, 1999.
48. **V. Kapila**, W. M. Haddad, and A. D. Grivas, "Stabilization of Linear Systems with Simultaneous State, Actuation, and Measurement Delays," *Int. J. Contr.*, Vol. 72, 1619–1629, 1999.
49. **V. Kapila** and W. M. Haddad, "Robust Stabilization for Systems with Parametric Uncertainty and Time Delay," *J. Franklin Inst.*, Vol. 336, 473–480, 1999.
50. W. M. Haddad and **V. Kapila**, "Mixed  $H_2/L_1$  Fixed-Architecture Controller Design for Multi-Input/Single-Output Systems," *J. Franklin Inst.*, Vol. 336, 435–448, 1999.
51. **V. Kapila** and W. M. Haddad, "Memoryless  $H_\infty$  Controllers for Systems with Time Delay," *Automatica*, Vol. 34, 1141–1144, 1998.
52. **V. Kapila**, W. M. Haddad, R. S. Erwin, and D. S. Bernstein, "Robust Controller Synthesis via Shifted Parameter-Dependent Quadratic Cost Bounds," *IEEE Trans. Autom. Contr.*, Vol. 43, 1003–1007, 1998.
53. W. M. Haddad and **V. Kapila**, "Robust Stabilization for Continuous-Time Systems with Slowly Time-Varying Uncertain Real Parameters," *IEEE Trans. Autom. Contr.*, Vol. 43, 987–992, 1998.
54. W. M. Haddad and **V. Kapila**, "Robust Controller Synthesis for Systems with Input Output Nonlinearities: A Tradeoff between Gain Variation and Parametric Uncertainty," *Int. J. Robust and Nonlinear Contr.*, Vol. 8, 567–583, 1998.
55. W. M. Haddad and **V. Kapila**, "Static Output Feedback Controllers for Continuous-Time and Discrete-Time Systems with Input-Output Nonlinearities," *European J. Contr.*, Vol. 4, 22–31, 1998.
56. W. M. Haddad, **V. Kapila**, and V.-S. Chellaboina, "Guaranteed Domains of Attraction for Multivariable Lur'e Systems via Open Lyapunov Surfaces," *Int. J. Robust and Nonlinear Contr.*, Vol. 7, 935–949, 1997.
57. W. M. Haddad and **V. Kapila**, "Fixed-Architecture Controller Synthesis for Systems with Input-Output Time-Varying Nonlinearities," *Int. J. Robust and Nonlinear Contr.*, Vol. 7, 675–710, 1997.
58. W. M. Haddad and **V. Kapila**, "Robust, Reduced-Order Modeling for State Space Systems via Parameter-Dependent Bounding Functions," *IEEE Trans. Autom. Contr.*, Vol. 42, 248–253, 1997.
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60. W. M. Haddad and **V. Kapila**, “Antiwindup Controllers for Systems with Input Nonlinearities,” *AIAA J. Guid. Contr. Dyn.*, Vol. 19, 1387–1390, 1996.
61. W. M. Haddad, **V. Kapila**, and E.G. Collins, Jr., “Optimality Conditions for Reduced-Order Modeling, Estimation, and Control for Discrete-Time Linear Periodic Plants,” *J. Math. Syst. Est. and Contr.*, Vol. 6, 437–460, 1996.
62. W. M. Haddad and **V. Kapila**, “Robust Stabilization for Discrete-Time Systems with Slowly Time-Varying Uncertainty,” *J. Franklin Inst.*, Vol. 333 (B), 71–84, 1996.
63. **V. Kapila** and W. M. Haddad, “A Multivariable Extension of the Tsytkin Criterion Using a Lyapunov Function Approach,” *IEEE Trans. Autom. Contr.*, Vol. 41, 149–152, 1996.
64. W. M. Haddad and **V. Kapila**, “Discrete-Time Extensions of Mixed- $\mu$  Bounds to Monotonic and Odd Monotonic Nonlinearities,” *Int. J. Contr.*, Vol. 61, 423–441, 1995.
65. W. M. Haddad and **V. Kapila**, “Absolute Stability Criteria for Multiple Slope-Restricted Monotonic Nonlinearities,” *IEEE Trans. Autom. Contr.*, Vol. 40, 361–365, 1995.
66. W. M. Haddad and **V. Kapila**, “A Periodic Fixed Structure Approach to Multirate Control,” *IEEE Trans. Autom. Contr.*, Vol. 40, 301–307, 1995.
67. W. M. Haddad, D. S. Bernstein, and **V. Kapila**, “Reduced-Order Multirate Estimation,” *AIAA J. Guid. Contr. Dyn.*, Vol. 17, 712–721, 1994.

#### E. Refereed Conference Publications:

1. D. Liu, Y. Liu, Y. Xing, S. Ghosh, and V. Kapila, “DDP-based Parachute Landing Optimization for A Humanoid,” *Proc. of IEEE International Symposium on Safety, Security, and Rescue Robotics*, 122-128, 2020. DOI: 10.1109/SSRR50563.2020.9292623.
2. D. Liu, H. Jeong, and V. Kapila, “Bidirectional LSTM-based Network for Fall Prediction in A Humanoid,” *Proc. of IEEE International Symposium on Safety, Security, and Rescue Robotics*, 129-135, 2020. DOI: 10.1109/SSRR50563.2020.9292620.
3. S.M. Chacko, A. Granado, A. RajKumar, and **V. Kapila**, “An Augmented Reality Spatial Referencing System for Mobile Robots,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 4446--4452, 2020. <https://ras.papercept.net/images/temp/IROS/files/2711.pdf>.
4. H.K. Wazir, S.R. Bethi, A. RajKumar, F. Caruso, and **V. Kapila**, “A Wearable Pendant Sensor to Monitor Compliance with Range of Motion Lymphatic Health Exercise,” *IEEE Int. Conf. of Engineering in Medicine and Biology Society*, 4588–4591, 2020. DOI: 10.1109/EMBC44109.2020.9175471
5. V. Jayasree-Krishnan, S.R. Bethi, S. Kumar, R.K.R. Jayanthi, S. Ghosh, P. Raghavan, and **V. Kapila**, “RehabFork: An Interactive Game-assisted Upper Limb Stroke Rehabilitation System,” *IEEE Int. Conf. of Engineering in Medicine and Biology Society*, 5757–5760, 2020. DOI: 10.1109/EMBC44109.2020.9176168.
6. S.R. Bethi, A. RajKumar, F. Vulpi, P. Raghavan, and **V. Kapila**, “Wearable Inertial Sensors for Exergames and Rehabilitation,” *IEEE Int. Conf. of Engineering in Medicine and Biology Society*, 4579–4582, 2020. DOI: 10.1109/EMBC44109.2020.9175428.
7. S.M. Chacko, A. Granado, and **V. Kapila**, “An Augmented Reality Framework for Robotic Tool-path Teaching,” *53rd CIRP Conference on Manufacturing Systems*, 1218–1223, 2020. PROCIR-D-19-02458.

8. A. Mallik, P. Sabouri, S. Ghosh, and **V. Kapila**, “Assessing the Effects of a Robotics Workshop with Draw-a-Robot Test (Fundamental),” *Proc. ASEE Annual Conference and Exposition*, 17, pages, June 2020. <https://peer.asee.org/34182>.
9. P. Sabouri, S. Ghosh, A. Mallik, and **V. Kapila**, “The Formation and Dynamics of Teacher Roles in a Teacher-Student Groupwork during a Robotic Project (Fundamental),” *Proc. ASEE Annual Conference and Exposition*, 16 pages, June 2020. <https://peer.asee.org/35323>.
10. S. Ghosh, P. Sabouri, and **V. Kapila**, “Examining the Role of LEGO Robots as Artifacts in STEM Classrooms (Fundamental),” *Proc. ASEE Annual Conference and Exposition*, 18 pages, June 2020. <https://peer.asee.org/34620>.
11. M.A. Gennert, N. Lotfi, J.A. Mynderse, M. Jethwani, and V. Kapila, “*Workshops for Building the Mechatronics and Robotics Engineering Education Community*,” *Proc. ASEE Annual Conference and Exposition*, 13 pages, June 2020. <https://peer.asee.org/35710>.
12. V. Jayasree-Krishnan, S. Ghosh J. Spiegler, P. Raghavan, and **V. Kapila**, “Task-specific Assistive Device (TAD): An Accessible Technological Solution for Upper-limb Disability,” *Proc. of the Design of Medical Devices Conference*, 6 pages, April, 2020.
13. A. RajKumar, J. Karsdon, F. Naftolin, and **V. Kapila**, “Electrical Inhibitor for Tocolytics,” *Proc. of the Design of Medical Devices Conference*, 6 pages, April, 2020.
14. S.M. Chacko and **V. Kapila**, “An Augmented Reality Interface for Human Robot Interaction in Unconstrained Environments,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 3222–3228, Macau, China, November 2019. DOI: [10.1109/IROS40897.2019.8967973](https://doi.org/10.1109/IROS40897.2019.8967973).
15. S.M. Chacko and **V. Kapila**, “Augmented Reality as a Medium for Human-Robot Collaborative Tasks,” *IEEE/RSJ International Conference on Robot and Human Interactive Communication (RO-MAN)*, 8 pages, New Delhi, India, October 2019. DOI: [10.1109/RO-MAN46459.2019.8956466](https://doi.org/10.1109/RO-MAN46459.2019.8956466).
16. S.P. Krishnamoorthy, A.P. Go, A. Tiwari, and **V. Kapila**, “Dark-Room Exchange: Human Supervision of Decentralized Multi-Robot Systems Using Distributed Ledgers and Network Mapping,” *IEEE/RSJ International Conference on Robot and Human Interactive Communication (RO-MAN)*, 8 pages, New Delhi, India, October 2019. DOI: [10.1109/RO-MAN46459.2019.8956454](https://doi.org/10.1109/RO-MAN46459.2019.8956454).
17. M.A. Gennert, N.Y. Lotfi, J. Mynderse, M.M. Jethwani, and **V. Kapila**, “Building the Mechatronics and Robotics Education Community,” *Proc. ASEE Annual Conference and Exposition*, 11 pages, <https://peer.asee.org/33598>, 2019.
18. S. Ghosh, S. Borges Rajguru, and **V. Kapila**, “Investigating Classroom-related Factors that Influence Student Perception of Utility of LEGO Robots as Educational Tools in Middle Schools (Fundamental),” *Proc. ASEE Annual Conference and Exposition*, 20 pages, <https://peer.asee.org/33023>, 2019.
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160. W. M. Haddad and **V. Kapila**, “Robust Stabilization for Discrete-Time Systems with Slowly Time-Varying Uncertainty,” *Proc. IEEE Conf. Dec. Contr.*, 202–207, 1995.
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166. W. M. Haddad and **V. Kapila**, “Discrete-Time Extensions of Mixed- $\mu$  Bounds to Monotonic and Odd Monotonic Nonlinearities,” *Proc. Amer. Contr. Conf.*, 1022–1026, 1994.
167. W. M. Haddad and **V. Kapila**, “Absolute Stability Criteria for Multiple Slope-Restricted Monotonic Nonlinearities,” *Proc. Amer. Contr. Conf.*, 1020–1021, 1994.
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169. W. M. Haddad, **V. Kapila**, and E.G. Collins, Jr., “Optimality Conditions for Reduced Order Modeling, Estimation, and Control for Discrete-Time Linear Periodic Plants,” *Proc. Amer. Contr. Conf.*, 2111–2115, 1993.

#### **F. Selected Lectures, Presentations, and Seminars:**

1. V. Kapila, Keynote Speaker: “Research and Education at the Convergence of Frontier Technologies,” First International Mechatronics Conference @ Oklahoma State University, Stillwater, OK, October 23–25, 2019.
2. V. Kapila, “Research @ the Convergence of Frontier Technologies,” The AI Summit, Session: Robotics, Jacob K. Javits Convention Center, NYC, December 5, 2018.
3. V. Kapila, “Research @ the Convergence of Disruptive Technologies,” Mechanical Engineering Seminar Series, New York City College of Technology, Brooklyn, NY, November 28, 2018.
4. V. Kapila, “Mechatronics and Robotics: A Platform for Interdisciplinary, Experiential Eng. Education,” International Forum on Engineering Education, Tsinghua University, China, September 23-24, 2018.
5. V. Kapila, “Mechatronics and Robotics @ NYU,” Presented at the On the Cusp of Industrial and Healthcare IOT, Organized by IBM IOT and Digileum, September 7, 2017.
6. V. Kapila, “Hands-on Mechatronics Education: An NYU Tandon Perspective,” Presented the Inaugural Webinar of the MechEdu Webinar Series, September 29, 2017.
7. V. Kapila, “Mechatronics Education Innovation Workshop @ NYU Tandon: A Report,” Presented at the Mechatronics 4.0 Workshop: Are Universities Ready, Technical University of Denmark, June 20, 2017.
8. V. Kapila, “Hands-on Mechatronics Education: An NYU Tandon Perspective,” Presented at the Mechatronics 4.0 Workshop: Are Universities Ready, Technical University of Denmark, June 21, 2017.
9. *NSF STEM Forum*, Washington, DC, November 9, 2015. “Lessons from a Research Experience for Teachers Site.” V. Kapila and J. Jadav (RET alumni).
10. Hindustan Institute of Technology and Science, Chennai, India, January 8, 2015. “Research and Education @ Mechatronics and Robotics Lab.”
11. *National Science Foundation RET Site Workshop*, Arlington, VA, April 28, 2014, “K-12 STEM Education: An NYU-SoE Perspective.” Invited Plenary Talk.
12. Southern Methodist University, Mechanical Engineering Department, Dallas, TX, November 13, 2013. “Mechatronics Research and K-12 STEM Education: An NYU-Poly Perspective.”
13. Brooklyn College, Brooklyn, NY, August 22, 2012, “GK–12 Fellows Program: A Model for K-12 STEM Education.”

14. *The Science UnSummit*, Washington DC, April 23–25, 2012, “GK–12 Fellows Program: A Model for K-12 STEM Education,” April 24, 2012, V. Kapila, U. Koniges, L. Outerbridge, and Ben Esner. Invited Presentation.
15. *Teacher Research Experience Conference*, Washington, D.C., October 22-24, 2010, organized by NOAA, “Poster: Science and Mechatronics Aided Research for Teachers (SMART).” Invited Presentation.
16. NSF GK-12 Fellows Project, New PI Meeting, Arlington, VA, March 26, 2010, “Sustaining a GK-12 Fellows Project.” Invited Presentation.
17. Polytechnic Institute of NYU, Board of Trustee’s Meeting, New York, NY, June 2009, “Integration of Mechatronics and Robotics in Brooklyn Schools,” (Led a presentation by a team of GK-12 Fellows).
18. North Carolina A&T University, Mechanical Engineering Department, Greensboro, NC, April 2009, “Saturation, Synchronization, and Mechatronics: Let’s Talk Controls.”
19. Mitsubishi Electric Research Laboratories, Cambridge, MA, July 2008, “Saturation, Synchronization, and Mechatronics: Let’s Talk Controls.”
20. Virginia Commonwealth University, Mechanical Engineering Department, Richmond, VA, April 2008, “Control Designs for Spacecraft Orbits and Chaos Synchronization.”
21. City College at the City University of New York, Mechanical Engineering Department, New York, NY, March 2008, “Saturation, Synchronization, and Mechatronics: Let’s Talk Controls.”
22. Villanova University, Mechanical Engineering Department, Villanova, PA, February 2008, “Handling the Effects of  $J_2$  Perturbation on Spacecraft Orbits.”
23. Polytechnic University, Honors College, Brooklyn, NY, March 2006, “Hands-on Mechatronics Education: A “Brooklyn Poly” Perspective.”
24. Drexel University, Mechanical Engineering and Mechanics Department, Philadelphia, PA, May 2005, “Hands-on Mechatronics Education: A “Brooklyn Poly” Perspective.”
25. Oregon State University, Mechanical Engineering Department, Corvallis, OR, April 2005, “Control Algorithms for Distributed Spacecraft Formation Reconfiguration and Initialization.”
26. Brigham Young University, Electrical and Computer Engineering Department, Provo, UT, June 2004, “Distributed Control for Spacecraft Formation Reconfiguration/Initialization.”
27. 17<sup>th</sup> Florida Conference on the Recent Advances in Robotics, University of Central Florida, Orlando, FL, May 2004, “Hands-on Mechatronics Education: A “Brooklyn Poly” Perspective.”
28. University of Tennessee, Mechanical and Aerospace Engineering Department, Knoxville, TN, April 2004, “Distributed Spacecraft Formation Control.”
29. City College at the City University of New York, Mechanical Engineering Department, New York, NY, March 2004, “Architectures and Algorithms for Distributed Spacecraft Formation Control.”
30. Air Force Research Laboratory, Space Vehicles Directorate, Kirtland AFB, NM, August 2002, “Adaptive Nonlinear Control for Spacecraft.”
31. University of New Mexico, Electrical and Computer Engineering Department, Albuquerque, NM, August 2002, “Control Algorithms and Architectures for Distributed Spacecraft Formations.”
32. National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD, May 2002, “Control Algorithms and Architectures for Distributed Spacecraft Formations.”

33. Michigan State University, Mechanical Engineering Department, East Lansing, MI, March 2002, "Control Algorithms and Architectures for Distributed Spacecraft Formations."
34. University of Alabama, Mechanical and Aerospace Engineering Department, Huntsville, AL, March 2002, "Control Algorithms and Architectures for Distributed Spacecraft Formations."
35. Air Force Research Laboratory, Control Sciences Division, WPAFB, OH, March 2001, "Control Algorithms and Architectures for Distributed Spacecraft Formations."
36. Air Force Research Laboratory, Space Vehicles Directorate, Kirtland AFB, NM, March 2001, "Control Algorithms and Architectures for Distributed Spacecraft Formations."
37. Polytechnic University, Mechanical Engineering Department, Brooklyn, NY, October 2000, "Web-Enabled Multidisciplinary Mechatronics/Process Control Laboratory."
38. Air Force Research Laboratory, Air Vehicles Directorate, WPAFB, OH, August 1999, "Spacecraft Formation Flying: Dynamics and Control."
39. Air Force Research Laboratory, Air Vehicles Directorate, WPAFB, OH, June, 1999, "Actuator Saturation Control."
40. Columbia University, Mechanical Engineering Department, New York, NY, March 1999, "Actuator Saturation Control."
41. Air Force Research Laboratory, Air Vehicles Directorate, WPAFB, OH, July, 1998, "Satellite Formation Flying."

**G. Others:****G1. Publication:**

1. V. Kapila and T. Lee, "Mechatronics Education Innovation Workshop: A Summary Report," *ASME Dynamic Systems and Control Magazine*, 6(1): 3-4, 2018.

**G2. U.S. Patent Granted:**

1. P. Raghavan and V. Kapila, “Game-based Sensorimotor Rehabilitator,” U.S. Patent and Trademark Office, U.S. Patent US 20160067136 A1, issued May 28, 2019.
2. R. Prieto, V. Kapila, J.A. Frank, and D.A. Lopez, “Universal Construction Robotics Interface,” U.S. Patent and Trademark Office, U.S. Patent US 9,292,015 B2, issued March 22, 2016. (Note: Robert (Bob) Prieto served as a judge for the 2012 NYU-SoE Inno/Vention Competition).

**G3. U.S. Patent Applications Filed:**

1. S. Krishnamoorthy and V. Kapila, “System Method and Computer-accessible Medium for Blockchain-based Distributed Ledger for Analyzing and Tracking Environmental Targets in Decentralized Robot Swarms, US 2019/0342731 A1, May 1, 2019.

**G4. Lecture Notes:**

1. **V. Kapila**, Lecture Notes for ME7863: Robots for Disability, NYU—SoE, Brooklyn, NY, 2015, CD-ROM.
2. **V. Kapila**, Lecture Notes for ME7863: Advanced Mechatronics, NYU-SoE, Brooklyn, NY, 2014, CD-ROM.
3. **V. Kapila**, Lecture Notes for ME3484: Mechatronics, Polytechnic University, Brooklyn, NY, 2004, CD-ROM.

**G5. Laboratory Manual:**

1. **V. Kapila**, Laboratory Experiment Manual for ME 325: Control Laboratory, NYU-Poly, Brooklyn, NY, 1999. Revised: 2008.

**G6. Organization of Conferences, Symposia, and Workshops:**

1. Co-Organizer: *Workshops for the Future of Mechatronic and Robotic Education* with N.L. Yagin, J. Mynderse, and M.A. Gennert. (a) ASME Dynamic Systems and Controls Conference, 2018, Atlanta, GA September 30, 2018; (b) Robotics Summit and Expo, Boston, June 6, 2019; (c) ASEE Annual Conference and Expo, Tampa, June 16, 2019; and Lawrence Technological University, Southfield, MI, September 27–28, 2019.
2. Sole-Presenter *Robotics Awareness Workshops*. Under a contract from ITAC, throughout summer’18 and fall’18, conducted six half-day sessions on Introduction to Robotics for small and medium scale companies in New York City. These sessions were designed to bring awareness of robotics to the local manufacturers and inform them about workforce development issues in this critical technology area. Pursuant to the workshops, two companies purchased robots (personal communication from a robot integrator and vendor, June 2019) and several companies invited and hosted Prof. Kapila for visits to their manufacturing facilities for consultations.
3. Organizer: *ITEEST Strategies: Promoting Robotic Design and Entrepreneurship Experiences among Students and Teachers*. In summer 2017, this effort hosted 18 teachers and 33 students from 10 high schools to undergo two-week guided training in robotics fundamentals and practice and a two-week collaborative robotic-product development. The project is employing project-based learning, robotics, and entrepreneurship to enhance participants’ robotics content

knowledge and self-efficacy. The project has continued to host additional teachers and students in summer 2018 (16 teachers and 36 students) and 2019.

4. Co-Organizer and Host: *NSF-funded Mechatronics Education Innovation Workshop*. On November 14-15, 2016, hosted a day-and-half long workshop in partnership with Dr. Tom Lee of Quanser Consulting, Inc., Canada. In addition to NSF funding, the workshop received partial support from industry sponsors (Dassault Systemes, National Instruments, and Quanser Inc.). The workshop consisted of following activities: an industry panel, an academic panel, a best practices session, demonstrations and lab tours, and a synthesis session to formulate recommendations. The workshop was attended by over 60 participants from 22 US states, Canada, UK, and Denmark. See: <http://engineering.nyu.edu/mechatronics/NSFWorkshop/>.
5. Co-Organizer and Host: *Mechatronics Education Workshop: Designing and Building Effective Programs*. On June 17, 2016, held a one-day workshop in partnership with Dr. Tom Lee of Quanser Consulting, Inc., Canada. The workshop was attended by over 20 participants, including many faculty from universities in the USA and Canada, to initiate discussions concerning the present trends and future prospects of the field. Participants discussed goals and challenges for mechatronics education programs as well as approaches to promote collaboration between university and industry professionals.
6. Organizer: *DR K-12: Teaching STEM with Robotics: Design, Development, and Testing of a Research-based Professional Development Program for Teachers*. In summer 2015, a cohort of four teachers (two pairs of science and math teachers from two middle schools) participated in this “pilot” three-week professional development project. In 2016 and 2017, cohorts of 20 and 23 teachers, respectively, participated in this project. The project is employing constructs of design-based research and technological-pedagogical-content knowledge to create effective professional development and standards-aligned science and math lessons that employ robotics for hands-on learning. In summer 2018, the project invited 6 alumni to co-develop robotics-based science lessons aligned with the three dimensional model of the Next Generation Science Standards under the 5E instructional framework. The resulting curriculum and lessons are now being disseminated through conferences, workshops, etc. (e.g., workshops at NYU Tandon, ASEE MidAtlantic States Conference 2019, ASEE Annual Conference 2020, etc.).
7. Co-Organizer: *Summer 2015 STEM Education Partnership Program*. Under this effort, 11 graduate engineering students (master instructors) have designed the curricula for the following tracks: robotics (7th and 10th grade) and science of smart cities (7th and 10th grade). From June 1-June 12, 2015, the master instructors conducted professional development for 42 undergraduate and graduate engineering students (instructors), divided into groups of 11 each. Each group of instructors is assigned to one of four tracks. In addition, instructors attended pedagogy instruction from June 15-June 17, 2015. Next, the master instructors and instructors worked collaboratively to conduct a professional development program for 30 middle and high school STEM teachers from June 29-July 1, 2015. This team then deployed from July 6-August 7, 2015, to conduct a summer program for 300+ students across five boroughs of NYC. Each track engaged  $\approx 75$  students, such that  $\approx 15$  students from each borough received experience in that track. In 2016, Summer STEM Education Partnership Program was offered again. Four master instructors (NYU Tandon graduate students) provided professional development to 17 NYU Tandon students, who in turn partnered with 15 high school teachers to conduct a five-week summer program in robotics for over 250 students.
8. Organizer: *Summer of STEM*, July 8, 2013. With full-support support of our faculty, administration, and staff colleagues, on July 8, 2013, we launched an array of K-12 STEM education projects under a unified umbrella and event titled “Summer of STEM.” This illustrates that our K-12 STEM efforts are being institutionalized through a broad base of support. The event was attended by well over 200 K-12 STEM participants. Dr. Theresa Maldonado, Director of



Engineering Education and Centers at NSF, served as the Plenary Speaker at the event. Other prominent speakers at the event included: (1) Fred Wilson—a venture capitalist whose tech investments have included Twitter, Tumblr, Foursquare, Zynga, and Kickstarter, (2) U.S. Representative Hakeem Jeffries, and other speakers from NYU-Poly and NYU. On July 10, 2014, we organized the second installment of the *Summer of STEM*. Ms. Carmen Fariña, Chancellor of NYC Schools, delivered the keynote address at the event. The Third Annual Summer of STEM was held on July 9, 2015 and included a plenary talk by Dr. Susan Singer, Division Director of the Division of Undergraduate Education, National Science Foundation. Other speakers who addressed the event included: Ms. Carmen Fariña, Chancellor of NYC Schools, and NYU-SoE Dean Dr. Katepalli Raju Sreenivasan. Summer of STEM has been institutionalized and was held in 2016, 2017, and 2018 as well.

9. Organizer: Workshop on *Enhancing K-12 STEM Education through LEGO-based Robotics* at the American Society of Engineering Education Annual Conference, Atlanta, GA, June 22, 2013. (Workshop conducted by a team of GK-12 Fellows: J. Hume, J. Muldoon, and V. Mwaffo).
10. Organizer: *NYU-Poly Inaugural Research Expo*, May 20, 2013. Led a team of NYU-Poly faculty, administration, and staff colleagues to plan, organize, and conduct the Inaugural Research Expo. Our team efforts led to a high visibility campus event featuring over 40 research demonstrations from each of our academic departments at the faculty, graduate, and undergraduate levels, as well as from our K-12 STEM initiative, cross-institutional projects, the Media Lab, and companies from our thriving Incubators. The event received significant print, online, and television media coverage. The Research Expo event has now been institutionalized and is held annually (May 2, 2014; April 24, 2015; April 27, 2016; April 21, 2017).
11. Organizer: *Teaching STEM with Robotics Workshop*, October 30, 2010, NYU-Poly. Attended by over 100 K-12 teachers. Following organizations supported and participated in this event: FIRST, LEGO Education, National Instruments, CMU Robotics Institute, and Vision Education. Additional workshops were conducted as follows: *i) Teaching STEM with Robotics Symposium* held at the Pace University, White Plains New York, for over a dozen K-12 teachers, May 14, 2011; *ii) 17 volunteer student mentors from the NY Academy of Sciences*, September 24, 2011; and *iii) a series of workshops for 25 K-12 teachers from urban, inner-city schools*, on November 19, December 10, and December 17, 2011.
12. Organizer: Workshop on *Integration of Mechatronics and Robotics in Brooklyn Schools* at the NSF GK-12 Fellows Project Annual Meeting, Washington, DC, March 29, 2009. (Workshop conducted by a team of GK-12 Fellows K. Williams, D. Irving, M. Hernandez, N. Abaid, J. Haghpanah, and P. Khazron).
13. Organizer: *AMPS/CBSI Professional Development Workshops* (2008–2015), Polytechnic Institute of NYU. From 2008–2015, AMPS/CBSI GK-12 STEM Fellows partnered with 50 K-12 teachers to integrate robotics-based hands-on lessons in a variety of science and math classes. Each year, these partnerships began during weeklong summer workshops and lasted through the entire academic year with weekly visits by the Fellows to teachers' classrooms.
14. Co-organizer: *Applied Science and Technology Institute (ASTI)*, Session I: May 20, 22, 28, 29, 2008 and Session II: May 23, 27, June 17, 18, 2008 at NYU-Poly. Attended by over 30 teachers from Community School Districts 24 and 32.
15. Co-organizer: *Workshop in Instrumentation, Sensors, and Engineering (WISE)*, August 13 to August 24, 2007 at Polytechnic University. Attended by 20 pre-college teachers from metropolitan NY and surrounding areas.
16. Organizer: *Summer Mechatronics Institute for Teachers (SUMMIT)*, July 16 to August 10, 2007 at Polytechnic University. Attended by 19 pre-college teachers from metropolitan NY and surrounding areas.

17. Organizer: *From the Lab to the Marketplace: Nanotechnology Symposium*, April 23, 2007. On behalf of the Othmer Institute at Polytechnic University, led a team of three faculty members, to organize and conduct this day-long symposium. Speakers included representatives from the National Science Foundation; New York State Office of Science, Technology and Academic Research; and leading nanotechnology researchers from academia. The symposium was attended by over 100 students and faculty from Polytechnic University and several local area universities.
18. Organizer and Host: *Inaugural New York City NSF GK-12 Grant Holders Meeting*, May 20, 2005, Polytechnic University. Approximately 100 representatives from the four NYC GK-12 projects (Poly: 1, CUNY: 1, Columbia: 2) attended the event. A team of 4 persons from the NSF GK-12 program in Washington, DC, and personnel from the NYC Board of Education also attended the event.
19. Organizer: *RAISE Professional Development Workshop*, January 22, 2005, Polytechnic University. Attended by 19 elementary, middle, and high school teachers from metropolitan NY and surrounding areas. In addition to these teachers, from 2004-2008, RAISE GK-12 STEM Fellows partnered with 16 teachers to integrate sensor-based hands-on lessons in a variety of science and math classes. Each year, these partnerships began during summer workshops and lasted through the entire academic year with weekly visits by the Fellows to teachers' classrooms.
20. Organizer: *Research Experience for Teachers Site Workshops*, July 10 to August 18, 2017; July 6 to August 14, 2015; July 7 to August 15, 2014; July 8 to August 16, 2013; July 5 to August 15, 2011; July 5 to August 13, 2010; July 6 to August 14, 2009; July 11 to August 5, 2005; July 12 to August 6, 2004; and July 14 to August 8, 2003 at Polytechnic University. Attended by 104 pre-college teachers from metropolitan NY and surrounding areas.
21. Organizer: *Web-Enabled Real-Time Experimental Control Workshop*, May 28, 2001 to May 31, 2001, Polytechnic University. Attended by 4 graduate students from various universities.
22. Organizer: *Real-Time Experimental Control Workshop*, May 29, 2000 to June 2, 2000, Polytechnic University. Attended by 7 graduate students from various universities.
23. Organizer: FM18 *Experimental Control Education*, American Control Conference, Chicago, IL, June 2000.
24. Organizer: WA14 *Cooperative Control of Multi-Agent Systems*, American Control Conference, Chicago, IL, June 2000.
25. Organizer: FA09 *Actuator Saturation Control*, American Control Conference, San Diego, CA, June 1999.
26. Organizer: FP07 *Spacecraft Formation Flying*, American Control Conference, San Diego, CA, June 1999.

### **3. TEACHING AND EDUCATIONAL INNOVATIONS**

#### **A. Illustrative Projects:**

- PI, NSF-Division of Research on Learning in Formal and Informal Settings: “ITEST Strategies: Promoting Robotic Design and Entrepreneurship Experiences among Students and Teachers.” September 2016—August 2019.<sup>51</sup>
- PI, NSF-Division of Engineering Education and Centers: “RET Site in Mechatronics and Robotics with Entrepreneurship and Industry Experiences.” May 2016—April 2019.<sup>52</sup>
- PI and Co-Director, NYC DoE, “Summer 2015 STEM Education Partnership Program.” February 2015—September 2015. Continued in 2016.
- PI, NSF-Division of Research on Learning in Formal and Informal Settings: “DR K-12: Teaching STEM with Robotics: Design, Development, and Testing of a Research-based Professional Development Program for Teachers.” September 2014—August 2018.<sup>53</sup>
- PI, NSF-Division of Engineering Education and Centers: “RET Site: **Science and Mechatronics Aided Research for Teachers with an Entrepreneurship experience (SMARTER).**” May 2012—April 2015.
- PI, Black Male Donor Collaborative/Brooklyn Community Foundation/Chase/Motorola/NY Space Grant/White Cedar Fund/Xerox: “**Central Brooklyn STEM Initiative (CBSI),**” July 2010—June 2016.<sup>54</sup>
- PI, NSF-Division of Engineering Education and Centers: “RET Site: **Science and Mechatronics Aided Research for Teachers (SMART).**” January 2009—December 20011.
- PI, NSF-Division of Graduate Education: “New, GK12: **Applying Mechatronics to Promote Science (AMPS).**” June 2008—May 2013.
- Co-Director, NYC—DoE: “Applied Science and Technology Institute,” May 2008—June 2009.
- PI/Co-Director, Independence Community Foundation/Chase Foundation/Motorola/NY Space Grant: “**Central Brooklyn Robotics Initiative (CBRI),**” July 2007—August 2010.
- PI, NYSED/Engineers of the Future Program: “**Summer Mechatronics Institute for Teachers (SUMMIT),**” May 2007—October 2007.<sup>55</sup>
- Co-PI, NYSED/Engineers of the Future Program: “Summer **Workshop in Instrumentation, Sensors and Engineering (WISE),**” May 2007—October 2007.<sup>56</sup>
- PI, NSF-Division of Graduate Education: “**Revitalizing Achievement by using Instrumentation in Science Education (RAISE).**” June 2004—May 2009.<sup>57</sup>
- PI, NSF-Division of Engineering Education and Centers: “Research Experience for Teachers Site in Mechatronics.” January 2003—December 2007.

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<sup>51</sup> See: <http://engineering.nyu.edu/mechatronics/ITEST/> for additional details.

<sup>52</sup> See: <http://engineering.nyu.edu/mechatronics/smart/> for additional details.

<sup>53</sup> See: <http://engineering.nyu.edu/mechatronics/DRK-12/> for additional details.

<sup>54</sup> See: <http://engineering.nyu.edu/gk12/amps-cbri/> for additional details.

<sup>55</sup> See: <http://engineering.nyu.edu/mechatronics/summit/> for additional details.

<sup>56</sup> See: <http://engineering.nyu.edu/gk12/WISE/> for additional details.

<sup>57</sup> See: <http://engineering.nyu.edu/gk12/> for additional details.

- PI, Polytechnic University-2002 *Jacobs Innovation Grant*: “A Toolkit for Mechatronics Projects,” December 2002.
- PI, American Society of Mechanical Engineering-Dynamic Systems and Control Division: “Real-Time Experimental Control Workshop for DSCD Membership.” September 1999–August 2001.
- Co-PI, NSF-Division of Undergraduate Education CCLI-Adaptation and Implementation Program: “Development of A Remote Access Internet Based Mechatronics/Process Control Laboratory,” (with A. Tzes-PI). July 1999–December 2001.<sup>58</sup>
- PI, ASHRAE: “Advanced Control Design for Active Noise Cancellation in HVAC-Ducts.” August 1999–July 2000.
- PI, ASHRAE: “Advanced Control Design for Off-Peak Ice Generation/Storage and Air Conditioning System.” August 1998–July 1999.

### **B. Course/Laboratory Development:**

- Collaborated with a colleague from NYU Stern (business school) to design and pilot a new cross-school course ***Commercialization of Frontier Technologies***. This course was conceived by Profs. Ginsberg (Stern) and Kapila (Tandon) following their service on the NYU Tandon Committee on Entrepreneurship and Innovation (summer 2017). Initial approval for conducting the pilot in spring 2019 was provided by NYU Tandon Dean in summer 2018. Students from Stern enrolled under an MGMT-GB 2321 course and students from Tandon enrolled under an M.S. Project course ME-GY 996X. In spring 2019 pilot, the course meetings were split equally between the Washington Square (Stern) and MetroTech (Tandon) campuses. Prof. Ginsberg provided instruction and guided students regarding the entrepreneurial aspects of the course while Prof. Kapila did the same about the mechatronics and robotics aspects. All students gained experiential learning experiences in working with various hardware and software elements of robotics (e.g., microcontrollers, sensors, actuators, electronics, and programming). Under Prof. Ginsberg’s active guidance, student teams analyzed and presented their findings on the commercialization viability of various on-going doctoral research activities in the MCRL. A colleague from the NYU Law School, along with two law students, provided legal input to student teams. This course redefined graduate education for business and engineering students, since these students learned to cross disciplinary boundaries to work with students from across two schools. In due course, such an experimentation is expected to benefit both schools and their students, e.g., by deepening their professional networks to enhance their career opportunities, potential for new intellectual property generation, and finally spurring some participants to explore startup ventures.
- Led the design and development of a new degree program ***M.S. in Mechatronics and Robotics***. Collaborated with faculty colleagues in creating the overall curricula, including the designs of course syllabi. Led, sought, and received institutional approvals (from Graduate Curriculum and Standards Committee and NYU SoE faculty) in fall 2014. Received approvals from the NYU Graduate Council in February 2015. Helped prepare the submission package for the NYS Education Department and received formal approval in November 2015. Helped design, create, and launch an online presence for the new degree program. The recruiting for the first cohort of students for fall 2016 started in earnest in January 2016 with Prof. Kapila conducting a webinar in collaboration with the Graduate Admission Office (February 4, 2016). In the interim, approximately 10 current students changed their major to obtain their M.S. degree in Mechatronics and Robotics. This program will modernize

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<sup>58</sup> For details, see: [http://engineering.nyu.edu/mechatronics/Control\\_Lab/](http://engineering.nyu.edu/mechatronics/Control_Lab/), <http://engineering.nyu.edu/mechatronics/mpcrl/>, and <http://engineering.nyu.edu/mechatronics/videos/> and the lab’s YouTube Channel: <https://www.youtube.com/channel/UCtNysasmvTikofnPrjDx9Zg>.

our curricula, make it relevant to students' interests, and address workforce demands for engineers having broad interdisciplinary training and practical experience in mechatronics and robotics. The launch of the new program has received significant coverage in on-line and print media outlets. In 2016, the new program had received: 87 total applications of which 33 were admitted, from whom  $\approx 20$  joined the program in fall'16. In 2017, the new program received over 100 applications of which less than 40 were admitted, from whom  $\approx 20$  joined the program in fall'17. For fall'19,  $\approx 50$  students have joined the program.

- Developed and pilot tested a new course *ME 7863 Robots for Disability* in spring 2015. The course introduces students to personal, societal, economic, and technological challenges related to physical disability, cognitive disability, and senior living. After an introduction to these challenges, students learn about current state of art assistive technologies, including mechatronics and robotics solutions, to enhance life for people with diverse abilities. Finally, they apply their mechatronics and robotics learning to produce novel technological solutions to address a specific problem related to a disability. In addition to didactic instruction, the course includes numerous audio-video illustrations of challenges of living with disability and diverse assistive technology solutions. Moreover, the course engages students in co-developing some of the course material through assigned readings, discussions, and presentations. Several students from the course also participated in the NYU Ability Lab and AT&T "Connect Ability Tech Innovation Challenge."
- Developed and introduced a new graduate course: *ME 7863 Advanced Mechatronics*. This course provides students an introduction to the theory and applications of microcontrollers and single-board computers for embedded system applications. Students gain familiarity with the fundamentals, anatomy, functionality, programming, interfacing, and protocols for microcontrollers and single-board computers (e.g., Arduino, multi-core Propeller, Raspberry Pi, etc.). The course includes lectures on introductory material, hands-on activities, and the design and development of prototype integrated mechatronic systems. Students learn hardware and algorithmic topics related to computer vision and create novel projects, e.g., robotics and the Internet of Things.
- Developed and introduced a sequence of two new undergraduate courses for interdisciplinary offering, namely: *Mechatronics—ME 3484* and *Smart Systems—ME 4484*. In the mechatronics course the students are introduced to the key building blocks of mechatronics systems and physical laws governing the operations of electro-mechanical components of mechatronics systems (e.g., sensors/actuators). The students gain proficiency in interfacing analog/digital sensors and actuators to physical plant and control hardware. They are also exposed to computer hardware/software for measurement and control such as data acquisition and control boards, micro-controllers (Basic Stamp), LabVIEW, Matlab, etc. Finally, throughout the course, planned project activities enable the students to integrate measurement, control, computer hardware, and software components to design, develop, and construct prototype mechatronics systems e.g., embedded control, remote sensing/monitoring/control, robotics, automation, etc. The smart systems course (developed jointly with Professor M. Tai) equips the students with essential tools frequently used to impart intelligence to a variety of systems. The course provides an introduction to the fundamentals of optimization theory, signal processing, system identification, estimation and control theory, condition monitoring, fault diagnostic, neuro-systems, decision systems (hierarchical/decentralized), distributed computing, etc. Applications of these tools in the design and development of smart systems are illustrated. Simulation and hardware projects enable the students to develop and analyze prototype smart systems such as smart sensors/actuators, flexible manufacturing/inspection cells, robotic manipulators, wheeled and legged robots, biologically inspired robots, etc. The mechatronics and smart systems course offerings began in spring 2003 and fall 2003, respectively.

- Introduced a graduate course titled *Optimal Robust Control—ME 770* and developed lecture notes that are used as the principal reading material for this course. Contents: fixed-structure and linear-matrix-inequality-based treatment of linear-quadratic regulation, filtering, and tracking control, mixed  $H_2/H_\infty$  filtering and control, singular-value based treatment of robust stability and performance problems, and quadratic bounds based guaranteed cost control. Using computer-aided control system analysis and design tools, the students design and evaluate controllers for mechanical, aerospace, robotic, and electrical systems.
- Revised *Discrete Time Feedback Control—ME 660* to include state-space based control, linear quadratic control, and Kalman filtering theories in discrete and digital domains.
- Revised *Nonlinear Control—ME 761* to provide our students a detailed development of absolute stability theory, multiplier theory, passivity, linear-matrix-inequality based stability analysis tools, actuator saturation control design, etc.
- Developed a graduate research/teaching computer-aided control design laboratory. The focus of this effort has been to provide the students hands-on experience in state-of the-art digital signal processing and PC-based control. The newly developed laboratory facilities consist of 6 Windows NT workstations, 1 dSPACE—DS1102, 2 Siglab, 3 Quanser—MultiQ real-time controller boards, and several experimental test-beds, e.g., single/double inverted pendulum on the cart, industrial servo, three degree-of-freedom under-actuated helicopter, two-tank level control system, and a magnetic levitation system.
- Developed a *web-enabled mechatronics/process control laboratory* (MPCRL) to completely revise and modernize the control laboratory curriculum and tools. This effort has focused on providing our undergraduate students hands-on experience in state-of the-art PC-based control. Concepts such as client-server environment, rapid controller prototyping, virtual instrumentation, automated code generation, etc., are emphasized. The revised and modernized laboratory was completed in summer 1999 and became operational in fall 1999 (*ME 325*). A new **laboratory manual** has also been prepared. The laboratory exposes the students to multidisciplinary aspects of control and is accessible from the world-wide-web. The newly developed laboratory facilities consist of: 14 Windows NT workstations, 20 Quanser—MultiQ real-time controller boards, 4 PIC microcontrollers, and numerous experimental test-beds, e.g., industrial servos, single/double rotary inverted pendulum, 2-DOF rotary inverted pendulum, magnetic levitation system, five DOF open architecture robots, rotary flexible link test-bed, earthquake simulator unit, two tank state- and input-coupled liquid level control unit, 3-DOF fully-actuated helicopters, active noise cancellation in a 1-D acoustic duct test-bed, liquid level and flow control rig, liquid temperature control unit, chemical concentration (pH) control rig, pressure control rig, wind-tunnel, radio controlled car, etc. See [http://engineering.nyu.edu/mechatronics/Control\\_Lab/](http://engineering.nyu.edu/mechatronics/Control_Lab/) for additional details. The MPCRL web site features include:
  - a web site that connects the students to online-experiments, which can be controlled and monitored through the Internet;
  - detailed specifications and operation manuals of various experiments;
  - prerecorded videos of selected experiments;
  - live streaming video of online-experiments;
  - a chat window to communicate with the other students and to form Internet-based remote learning communities; and
  - links to other control related web sites.

These features of the MPCRL provide the students with a wealth of information and virtually unlimited access to the laboratory test-beds and motivate them to take an active role in their education. See <http://engineering.nyu.edu/mechatronics/mpcrl/> for additional details.

### C. K–12 STEM Innovation:

- *Tuition-based STEM Programming for High School Students:* Envisioned and led a tuition-based STEM education program that was piloted in summer 2018 in partnership with and under the leadership of S. Borges Rajguru of NYU Tandon K-12 STEM Center. B. Esner (also of K-12 Center) provided additional support. The program is titled: “Summer Program for Automation Robotics and Coding (SPARC).” The program generated a revenue of **\$124,000** in summer 2018 and it provided support for four NYU Tandon M.S. students. Following the successful 2018 pilot, developed and championed a business-plan (including support for doctoral, M.S., and undergraduate students) that was approved in discussions with NYU Tandon administration for scale-up. In summer 2019, we are conducting this fee-based program in three topics (robotics, machine learning, and IoT—with full commitment and support from an array of our robotics, machine learning, and IoT faculty colleagues). S. Borges Rajguru continues to provide administrative leadership for this project that will diversify our funding base for K-12 activities. This initiative generated a revenue of over **\$300,000** in summer 2019. The business plan seeks to scale this activity to 500 students with over **one million dollars** in revenue by 2023.
- *K-12 STEM Lessons:* Under the AMPS/CBSI GK-12 Fellows project, since 2009, our team of graduate GK-12 Fellows has developed over 80 engineering-based, standards-aligned, K-12 science and math activities (see: [http://engineering.nyu.edu/gk12/amps-cbri/html/resources/classroom\\_menu.html](http://engineering.nyu.edu/gk12/amps-cbri/html/resources/classroom_menu.html)). Since the beginning of 2012, over 70 of these activity lessons have been published on Teachengineering.org (part of the National Science Foundation funded National Science Digital Library). All the published activities are authored by our GK-12 Fellows and acknowledge the support of AMPS/CBSI project (see: <http://engineering.nyu.edu/gk12/amps-cbri/html/resources/Teachengineering.html>). Many other activity lessons are in the review/copyediting process. As the project PI, Prof. Kapila encourages all GK-12 Fellows to prepare and submit activity lessons to Teachengineering. At the beginning of this publication activity, he devoted significant effort to mentor Fellows by suggesting activity concepts to explore and develop and by revising and editing their draft activity lessons. However, he does not list himself as a co-author on any of these activity lessons.

A personal communication by an editor of Teachengineering.org in January 2016 indicated: “Your 66 LEGO activities had a total of 106,730 page views in 2015. Five of those activities were in our ‘top 10’ for the year.” Per a follow-up communication: “8 of NYU’s lessons/activities were in the top quartile of our page views for 2015 (>3,000 page views). Another 18 of NYU’s lessons/activities fall above the median (1,000 page views).” Another follow-up communication in April 2017 indicated: “Over the past 365 days: NYU lessons/activities had 141,625 pageviews; 13 lessons/activities had more than 3,000 pageviews; an additional 22 activities had more than 1,000 pageviews; 16 were in the top quartile ( $\geq 2,430$  pageviews) 5 were in the top 10% ( $\geq 5867.5$  pageviews). The aforementioned page view data reflects the popularity of our robotics-based STEM lessons.

**4. TEACHING/ACADEMIC ACTIVITY**

**A. Instruction in System Dynamics, Feedback Control, and Mechatronics:**

- Undergraduate: ME261 Vibrations, ME321 Instrumentation, ME322/ME3413 Automated Controls, ME 325/ME3411 Control Laboratory, ME2514: Measurement Systems, ME3424: Dynamic Systems and Control 2, and ME3484/ME3483: Mechatronics.
- Graduate: ME6703 Linear Control I, ME5643 Mechatronics, ME660 Discrete Time Feedback Control, ME761/ME7613 Nonlinear Control, and ME770/ME7703 Optimal Robust Control, ME6933 Advanced Mechatronics and ME7933 Robots for Disability.

**Courses Taught**

**Fall Courses**

<b>Year</b>	<b>Course</b>	<b>Enrollment</b>	<b>Remarks</b>	<b>Evaluation</b>
2019	ME-GY7933	6	Robots for Disability	3.2/5
2018	ME-GY7933	3	Robots for Disability	N/A
2017	ME-GY7933	7	Robots for Disability	4/5
2016	ME-GY 6933	4	Advanced Mechatronics	5/5
2016	ME-GY7933	7	Robots for Disability	4.4/5
2015	ME-GY 5643	26	Mechatronics	4.2/5
2014	ME7703	4	Optimal Robust Control	N/A
2012	ME5643	23	Mechatronics	4.83/5
2012	ME6703	30	Linear Control Theory and Design I	4.08/5
2011	ME5643	17	Mechatronics	4.42/5
2011	ME6703	25	Linear Control Theory and Design I	4.42/5
2010	ME5643	9	Mechatronics	5/5
2010	ME6703	28	Linear Control Theory and Design I	3.85/5
2009	ME5643	17	Mechatronics	N/A
2009	ME6703	26	Linear Control Theory and Design I	4.33/5
2008	ME6703	17	Linear Control Theory and Design I	4.5/5
2007	ME3513	42	Measurement Systems	4.31/5
2007	ME3511	42	Measurement Systems Lab	3.47/5
2006	ME3483	16	Mechatronics (Revised 3 credit course)	4.1/5
2006	ME660	19	Discrete Time Feedback Control	3/5
2005	ME2514	21	Measurement Systems (with lab)	3.31/5
2005	ME 4514	36	Senior Lab (Control Lab Portion)	N/A
2004	ME 660	13	Discrete Time Feedback Control	3.71/5
2004	ME 4514	35	Senior Lab (Control Lab Portion)	3.96/5
2003	ME 660	6	Discrete Time Feedback Control	4.33/5
2003	ME 4514	19	Senior Lab (Control Lab Portion)	3.75/5
2002	ME325	8	Control Lab	3.66/5
2002	ME 660	5	Discrete Time Feedback Control	5/5
2001	ME 321	17	Instrumentation	3.63/5
2001	ME 325	9	Control Lab	4/5
2001	ME 660	4	Discrete Time Feedback Control	N/A
2000	ME 321 (BK) <sup>59</sup>	15	Instrumentation (Distance learning)	3.63/5
2000	ME 321 (FM) <sup>52</sup>	6	Instrumentation (Distance learning)	3.25/5

<sup>59</sup> BK: Brooklyn campus and FM: Farmingdale campus.



2000	ME 325 <sup>60</sup>	11	Control Lab (Web-based lab development)	4.15/5
2000	ME 660	8	Discrete Time Feedback Control	N/A
1999	ME 325 (BK)	10	Control Lab (Lab development)	3.33/5
1999	ME 325 (FM)	2	Control Lab (Lab development)	N/A
1999	ME 660	10	Discrete Time Feedback Control	N/A
1998	ME 761	5	Revised-Nonlinear Control	5 /5
1998	ME 660	11	Discrete Time Feedback Control	N/A
1997	ME 660	12	Discrete Time Feedback Control	N/A
1996	ME 660	10	Revised-Discrete Time Feedback Control	N/A

**Spring Courses**

<b>Year</b>	<b>Course</b>	<b>Enrollment</b>	<b>Remarks</b>	<b>Evaluation</b>
2019	ME-GY 996X	18	Commercialization of Frontier Tech. <sup>61</sup>	N/A
2019	ME-GY 6933	15	Advanced Mechatronics	4.4/5
2018	ME-GY 6933	22	Advanced Mechatronics	3.7/5
2017	ME-GY 6933	25	Advanced Mechatronics	3.91/5
2016	ME-GY 6933	6	Advanced Mechatronics	5.0/5
2015	ME7863 A	6	Robots for Disability (new course)	4.7/5
2015	ME7863 B	9	Advanced Mechatronics	4.6/5
2014	ME7863	7	Advanced Mechatronics (new course)	4.6/5
2013	ME3413	26	Automatic Control	4.0/5
2013	ME7703	5	Optimal Robust Control	4.5/5
2012	ME7613	8	Nonlinear Systems and Control	4.66/5
2011	ME7703	7	Optimal Robust Control	4.5/5
2010	ME7613	14	Nonlinear Systems and Control	2.8/5
2010	ME3413	17	Automatic Control	3.5/5
2009	ME3413	45	Automatic Control	2.86/5
2009	ME5643	19	Mechatronics	4.42/5
2008	ME5643	26	Mechatronics	4.14/5
2008	ME3411	41	Automatic Control Lab	4.18/5
2007	ME3413	39	Automatic Control	3.75/5
2007	ME3411	37	Automatic Control Lab	3.82/5
2006	ME3413	33	Automatic Control	3.48/5
2006	ME3411	28	Automatic Control Lab	N/A
2005	ME2514	53	Measurement Systems	3.43/5
2005	ME3424	40	Dynamics Systems and Control 2	3.44/5
2004	ME2514	28	Measurement Systems	4/5
2004	ME3484	19	Mechatronics	3.7/5
2003	ME2514	26	Measurement Systems	4.35/5
2003	ME3484	30	Mechatronics (new course)	3.88/5

<sup>60</sup> An advanced version of this course was simultaneously offered to 2 civil engineering graduate students as a special topic (ME 786), bringing the total enrollment to 13.

<sup>61</sup> This course was a pilot collaboration between NYU Tandon and NYU Stern (business school). NYU Tandon M.S. in Mechatronics and Robotics students and NYU Stern M.B.A. students took the course co-taught by Prof. Kapila and Prof. A. Ginsberg. NYU Stern course number: MGMT-GB 2321.

2002	ME761	8	Nonlinear Control	4.66/5
2002	ME324	15	Instrumentation Lab	4.37/5
2002	ME2514	13	Measurement Systems (4 credit course, with lab)	3.83/5
2001	ME 322	11	Automated Controls	3.77/5
2001	ME 324 (BK)	11	Instrumentation Lab (TA supervision)	N/A
2001	ME 324 (FM)	7	Instrumentation Lab (TA supervision)	N/A
2001	ME 770	5	Optimal Robust Control	4.80/5
2000	ME 261	5	Vibrations	4.60/5
1999	ME 261	9	Vibrations	4.66/5
1999	ME 887	2	Special Topics: Optimal Robust Control	N/A
1998	ME 887	2	Special Topics: Optimal Robust Control	N/A
1997	ME 322	12	Automated Controls	N/A
1997	ME 887	12	Special Topics: Optimal Robust Control (new course)	4/5

**B. Graduate/Undergraduate Student Thesis Advising:**

***B.1. Ph.D. Students***

S. No.	Student Name	Degree	Start Date	Date of Graduation
1.	Mr. Haizhou Pan	Ph.D.	Fall 1998	Spring 2002 <sup>62</sup>
2.	Mr. Qiguo Yan	Ph.D.	Fall 1998	Summer 2002 <sup>63</sup>
3.	Mr. Hong Wong	Ph.D.	Fall 2002	Spring 2007 <sup>64</sup>
4.	Mr. Sang-Hoon Lee	Ph.D.	Spring 2002	Fall 2008 <sup>65</sup>
5.	Mr. Jared Alan Frank	Ph.D.	Spring 2013	Summer 2017 <sup>66</sup>
6.	Mr. Ashwin RajKumar	Ph.D.	Spring 2015	Spring 2020 <sup>67</sup>
7.	Mr. Sai Prasanth Krishnamoorthy	Ph.D.	Spring 2017	Summer 2020 <sup>68</sup>
8.	Ms. Sonia Mary Chacko	Ph.D.	Summer 2016	Summer 2020 <sup>69</sup>
9.	Ms. Veena Jayasree-Krishnan	Ph.D.	Summer 2016	Summer 2020 <sup>70</sup>
10.	Mr. Abhidipta Mallik	Ph.D.	Summer 2016	Summer 2020 <sup>71</sup>

<sup>62</sup> Dissertation Title: Control of Nonlinear Systems with Applications. Completed: April 2002.

<sup>63</sup> Dissertation Title: Microsatellite Formation Flying. Completed: August 2002.

<sup>64</sup> Dissertation Title: Formation Design and Nonlinear Control of Spacecraft Formation Flying. Completed December 2006.

<sup>65</sup> Dissertation Title: Microcontroller-based Data Acquisition and Control with Applications. Completed September 2008.

<sup>66</sup> Dissertation Title: Mobile Devices as Platforms for Estimation, Control, and Enhanced Interactions with Physical Systems, Completed: August 2017.

<sup>67</sup> Dissertation Title: Technology Translation of Medical Devices for Rehabilitation and Therapeutics, Completed: May 2020.

<sup>68</sup> Dissertation Title: Decentralization of Homogeneous Multi-robot Systems using Distributed Ledgers and its Applications, Completed: July 2020.

<sup>69</sup> Dissertation Title: Investigating Prospects of Augmented Reality in Human-Robot Interactions, Completed: August 2020.

<sup>70</sup> Dissertation Title: Task-Specific Mechatronic and Robotic Solutions for Upper-Extremity Rehabilitation and Assistance, Completed: August 2020.

<sup>71</sup> Dissertation Title: Towards Enhancement of Technical Education Through Robotics Workshops and Development of AR/VR-based Testbeds, Completed: August 2020.

**B.2. M.S. Students**

S. No.	Student Name	Degree	Start Date	Date of Graduation
1.	Mr. Sang-Hoon Lee	M.S.	Fall 1999	Fall 2001 <sup>72</sup>
2.	Mr. Hong Wong	M.S.	Fall 2000	Spring 2002 <sup>73</sup>
3.	Mr. Guang Yang	M.S.	Fall 2000	Spring 2002 <sup>74</sup>
4.	Mr. Dariusz Majewski	M.S.	Fall 2001	Spring 2003 <sup>75</sup>
5.	Ms. Tanya Mamedalin	M.S.	Fall 2001	Spring 2005 <sup>76</sup>
6.	Mr. Christopher C. Wilkins	M.S.	Fall 2005	Spring 2007 <sup>77</sup>
7.	Mr. Sookram Sobhan	M.S.	Fall 2004	Spring 2007 <sup>78</sup>
8.	Mr. Chandreshkumar D. Dubey	M.S.	Fall 2007	Spring 2010 <sup>79</sup>
9.	Mr. Xiaoyang Lin	M.S.	Fall 2010	Spring 2012 <sup>80</sup>
10.	Mr. Jared Alan Frank	M.S.	Summer 2010	Fall 2012 <sup>81</sup>
11.	Ms. Irina Igel	M.S.	Summer 2011	Fall 2012 <sup>82</sup>
12.	Mr. Hussein Saab	M.S.	Summer 2011	Spring 2013 <sup>83</sup>
13.	Mr. Giancarlo Gramazio	M.S.	Spring 2013	Summer 2013 <sup>84</sup>
14.	Mr. David Lopez	M.S.	Fall 2011	Fall 2013 <sup>85</sup>
15.	Mr. Dario Cassano	M.S.	Spring 2013	Fall 2013 <sup>86</sup>
16.	Mr. Alessandro Marra	M.S.	Spring 2013	Fall 2013 <sup>87</sup>
17.	Mr. José A.D.G. Gómez	M.S.	Summer 2014	Summer 2015 <sup>88</sup>
18.	Mr. Anthony Brill	M.S.	Summer 2014	Summer 2016 <sup>89</sup>
19.	Mr. Matthew Moorhead	M.S.	Summer 2014	Summer 2016 <sup>90</sup>
20.	Mr. Karim Chamaa	M.S.	Summer 2016	Fall 2016 <sup>91</sup>
21.	Mr. Sai Prasanth Krishnamoorthy	M.S.	Spring 2016	Fall 2016 <sup>92</sup>

<sup>72</sup> M.S. Project Title: pH Process Control. Completed December 2001.

<sup>73</sup> Thesis Title: Adaptive Control of Spacecraft. Completed: April 2002.

<sup>74</sup> Thesis Title: Some Optimization Problems in Cooperative Control. Completed: April 2002.

<sup>75</sup> M.S. Project Title: PC-Based Real-Time Control of A Pressure Process Rig. Completed June 2003.

<sup>76</sup> M.S. Project Title: Parallel Port Control of A Mobile Omnidirectional Robot. Completed June 2005.

<sup>77</sup> Thesis Title: Counteracting the Effect of Earth's Oblateness on Spacecraft Orbits. Completed: May 2007.

<sup>78</sup> M.S. Project Title: Development of a Sensor Node for Wireless Sensor Networks. Completed: June 2007.

<sup>79</sup> Thesis Title: Damage Detection in Beam Structures using Chaotic Excitation. Completed: May 2010.

<sup>80</sup> M.S. Project Title: A Remote Motion Control Interface for CRS Robotic Manipulator. Completed: May 2012.

<sup>81</sup> Thesis Title: Multimodal Mobile Apps for Intuitive Human-Machine Interaction, Completed: January 2013.

<sup>82</sup> Thesis Title: Binaural Sensing Device for Autonomous, Mobile Robots, Completed: January 2013.

<sup>83</sup> Thesis Title: Dynamic Obstacle Avoidance with Size Consideration for Mobile Robotics, Completed: May 2013.

<sup>84</sup> M.S. Project Title: A Camera-based Control for a Four Degrees of Freedom Robot, Completed: August 2013.

<sup>85</sup> Thesis Title: Tablet-based Tactically Immersive Interfaces for Intuitive Teleoperation of Mobile Manipulators, Completed: January 2014. Received the Best MAE Department M.S. Thesis Award, Spring'15.

<sup>86</sup> M.S. Project Title: Design and Kinematics of A Passive Dynamic Humanoid Biped Robot, Completed: December 2013.

<sup>87</sup> M.S. Project Title: An Implementation of the Inertial Navigation System by using A Mobile Phone for Subway Transportation, Completed: December 2013.

<sup>88</sup> Interactive Robot Manipulator, Completed: August 2015.

<sup>89</sup> Thesis Title: Exploring the Role of Smartphones as a Platform for Feedback Control with Applications in Engineering Education, Completed: September 2016.

<sup>90</sup> Thesis Title: Mixed-Reality Human Robot Interaction using Tablets, Completed: September 2016.

<sup>91</sup> M.S. Project Title: A Mobile Robot Platform Dedicated for Assisting People with Mobility Impairments, Completed: December 2016.

<sup>92</sup> M.S. Project Title: Robotic Puppet, Smart Glove, and iOS application-based Human-Robot Interaction, Completed: December 2016.

S. No.	Student Name	Degree	Start Date	Date of Graduation
22.	Mr. Haiming Gang	M.S.	Fall 2016	Spring 2017 <sup>93</sup>
23.	Mr. Angad Anil Boralkar	M.S.	Spring 2017	Summer 2017 <sup>94</sup>
24.	Mr. Mitavarun Anand	M.S.	Spring 2017	Summer 2017 <sup>95</sup>
25.	Ms. Tanaya Bhawe	M.S.	Spring 2017	Summer 2017 <sup>96</sup>
26.	Ms. Shweta Madhubhai Vaviya	M.S.	Spring 2017	Fall 2017 <sup>97</sup>
27.	Mr. Abhimanyu Dhawan	M.S.	Fall 2017	Spring 2018 <sup>98</sup>
28.	Mr. Vignesh Ramesh Pai	M.S.	Fall 2017	Spring 2018 <sup>99</sup>
29.	Mr. Sridhar C. Parthasarathy	M.S.	Fall 2017	Spring 2018 <sup>100</sup>
30.	Mr. Gaurav Shetty	M.S.	Fall 2017	Spring 2018 <sup>101</sup>
31.	Mr. Shreyance Singhvi	M.S.	Fall 2017	Spring 2018 <sup>102</sup>
32.	Mr. Ziyu Wang	M.S.	Fall 2017	Spring 2018 <sup>103</sup>
33.	Mr. Hassam Khan Wazir	M.S.	Fall 2017	Spring 2018 <sup>104</sup>
34.	Mr. Jing Xia	M.S.	Fall 2017	Spring 2018 <sup>105</sup>
35.	Mr. Ezra Idy	M.S.	Fall 2017	Summer 2018 <sup>106</sup>
36.	Mr. Chetan Arora	M.S.	Fall 2018	Spring 2019 <sup>107</sup>
37.	Mr. Chaitanya Shrikanth Kabade	M.S.	Fall 2018	Spring 2019 <sup>108</sup>
38.	Mr. Xuchu Xu	M.S.	Fall 2018	Spring 2019 <sup>109</sup>
39.	Mr. Fabio Vulpi	M.S.	Spring 2019	Summer 2019 <sup>110</sup>
40.	Mr. Fabio Caruso	M.S.	Summer 2019	Summer 2019 <sup>111</sup>

<sup>93</sup> M.S. Project Title: An Autonomous Mobile Robotic System to Assist Disabled Persons in Daily Activities, Completed: May 2017.

<sup>94</sup> M.S. Project Title: 6-DoF Collaborative Manipulator Robot for Assistance in Surgery, Completed: August 2017.

<sup>95</sup> M.S. Project Title: Convolutional Neural Network-Based Autonomous Mobile Robot for Industrial Material Transfer, Completed: September 2017.

<sup>96</sup> M.S. Project Title: A TotBot and A Tooth Extraction Module, Completed: September 2017.

<sup>97</sup> M.S. Project Title: Upper Extremities Rehabilitation Monitoring using Wearable Sensor, Completed: January 2018.

<sup>98</sup> M.S. Project Title: Autonomous Library Organizer (ALO), Completed: May 2018.

<sup>99</sup> M.S. Project Title: Automated Bottle Packaging System and Bottle Assembler (collaborative projects), Completed: May 2018.

<sup>100</sup> M.S. Project Title: Swarm Robotics Game, Completed: May 2018.

<sup>101</sup> M.S. Project Title: Automated Bottle Packaging System (collaborative project) and Automated Coil Spring Sorter, Completed: May 2018.

<sup>102</sup> M.S. Project Title: Automated Bottle Packaging System and Bottle Assembler (collaborative projects), Completed: May 2018.

<sup>103</sup> M.S. Project Title: Autonomous Food Delivery Robot Cart on Airplane, Completed: May 2018.

<sup>104</sup> M.S. Project Title: Mobile Mixed-Reality Interaction Using Computer Vision for Robot Control, Completed: May 2018.

<sup>105</sup> M.S. Project Title: Autonomous Ground Robot for Fruit Counting at Orchard using SLAM and Machine Learning, Completed: May 2018.

<sup>106</sup> M.S. Project Title: Swarm Robotics Camera System, Completed: August 2018.

<sup>107</sup> M.S. Project Title: Neighbor Assessment using Cameras and Deep-Learning, Completed: May 2019.

<sup>108</sup> M.S. Project Title: Myo Armband Controlled Gaming for Task Specific Stroke Rehabilitation, Completed: May 2019.

<sup>109</sup> M.S. Project Title: Weight-Driven Supply Chain Optimization Technology, Completed: May 2019.

<sup>110</sup> M.S. Thesis Title: Wearable Inertial Sensors for Upper Extremity Range of Motion Assessment, Completed: August 2019.

<sup>111</sup> M.S. Project Title: Design of A Wearable Device used to Measure Joint angles in Rehabilitation, Completed: August 2019.

S. No.	Student Name	Degree	Start Date	Date of Graduation
41.	Mr. Satish Reddy Bethi	M.S.	Fall 2018	Spring 2020 <sup>112</sup>
42.	Mr. Armando Granado	M.S.	Summer 2019	Spring 2020 <sup>113</sup>
43.	Mr. Sahil Kumar	M.S.	Summer 2019	Spring 2020 <sup>114</sup>
44.	Mr. Yang Liu	M.S.	Summer 2019	Spring 2020 <sup>115</sup>
45.	Ms. Zeru Zhang	M.S.	Summer 2019	Spring 2020 <sup>116</sup>

**B.3. B.S. Students**

S. No.	Student Name	Degree	Start Date	Date of Graduation
1.	Mr. Valentin Siderskiy	B.S.	Spring 2013	Fall 2013 <sup>117</sup>

**C. Thesis/Dissertation Committees:**

S. No.	Student Name	Degree	Major	Start Date	End Date
1.	Mr. K. Le	Ph.D.	Mech.	9/96	12/96
2.	Mr. H. Melkote	M.S.	Elect.	9/96	12/96
3.	Mr. S. Sankaranarayanan	M.S.	Elect.	1/98	2/98
4.	Mr. N. Ahmed	Ph.D.	Elect.	2/98	7/98
5.	Mr. H. Melkote	Ph.D.	Elect.	-	7/99
6.	Mr. Z. Wang	Ph.D.	Elect.	4/00	5/01
7.	Mr. P. Krishnamurthy	M.S.	Elect.	-	1/02
8.	Mr. J. Zhu	Ph.D.	Mech.	3/02	11/02
9.	Mr. P. Krishnamurthy	Ph.D.	Elect.	5/02	1/06
10.	Mr. Jianjun Liu <sup>118</sup>	Ph.D.	Mech.	-	1/07
11.	Mr. Nguyen Nguyen	Ph.D.	Mech.	10/08	04/09
12.	Mr. Walid Abou Moussa	Ph.D.	Civil	-	10/08
13.	Mr. Gianluca Notaro	M.S.	Mech.	-	12/08
14.	Ms. Francesca Fiorilli	Ph.D.	Mech.	06/09	5/11
15.	Mr. Vlad Kopman	M.S.	Mech.	-	09/09
16.	Ms. Nicole Abaid	Ph.D.	Mech.	09/09	5/12
17.	Mr. Matteo Aureli	Ph.D.	Mech.	02/11	5/12
18.	Mr. Vlad Kopman	Ph.D.	Mech.	07/11	5/13
19.	Ms. Ann Mary Noble	M.S.	Elect.	-	11/11
20.	Mr. Ritchy Laurent	M.S.	Elect.	-	11/11
21.	Ms. Dustyn Roberts	Ph.D.	Mech.	9/12	9/14
22.	Mr. Chang B. Joo	Ph.D.	Mech.	10/12	5/14
23.	Mr. Youngsu Cha	Ph.D.	Mech.	7/13	5/15
24.	Ms. Carlotta Mummolo	Ph.D.	Mech.	4/14	12/15

<sup>112</sup> M.S. Thesis Title: Exergames for Telerehabilitation, Completed: May 2020.

<sup>113</sup> M.S. Project Title: Augmented Reality Application in Robotics for Senior Citizens, Completed: May 2020.

<sup>114</sup> M.S. Project Title: PHYS.I.O.—Physiotherapy using Instruments Online, Completed: May 2020.

<sup>115</sup> M.S. Project Title: Analysis of Humanoid Robot Parachute Landing Process, Completed: May 2020.

<sup>116</sup> M.S. Project Title: The Design of a Wearable Sensor for Extremities' Movement Monitoring in Rehabilitation, Completed: May 2020.

<sup>117</sup> B.S. Thesis: Parameter Matching using Adaptive Synchronization of Chua's Circuit, Completed: January 2014.

<sup>118</sup> Served as an external member of Mr. Liu's dissertation committee at the City University of New York.

S. No.	Student Name	Degree	Major	Start Date	End Date
25.	Mr. Paul Phamduy	Ph.D.	Mech.	2/15	12/16
26.	Mr. Violet F. Mwaffo	Ph.D.	Mech.	6/15	5/17

**D. Senior Design Advising:**

1. A. Smotritsky and N. Chen, “Computer Controlled Ice Bank Storage Cooling System,” 1999.
2. J. Wang and C.-F. Ng-Lai, “Real-Time Control System for a Solar Panel,” 1999.
3. H. Wong and D. Sadeghi, “Active Noise Cancellation System for an HVAC Duct,” 2000. Best M.E. Senior Design, spring 2000.
4. G. Gonzalez, P. J. Paredes, and C. Szalaien, “Automated Laser Doppler Anemometry Controller,” 2002.
5. D. Bacskey, S. W. Cheung, D. Chow, L. Competello, and B. Kim, “The Collinear Wheeled Self-Balancing Robot,” 2003.
6. M. Cruz, S. Harari, M. King, and T. King, “ARVe: Autonomous Reconnaissance Vehicle,” 2004.
7. I. Ahmed and N. Alam, “System for Wireless Adaptable Notification (SWAN),” 2004.
8. D. Flesché, M. Salman, S. Silverberg, J. Wagh, “Remote Military Demobilization System with Stereo Vision & Mobile Droid,” 2005.
9. R. Pastor, E. Lee, C. Bacon, F. Mudasar, and W. Kok, “Motor-less Locomotive System for Robots,” 2006.
10. R. Trulov, K. Ruamyarti, T.-M. Pham, and N. Brathwaite, “Robo-Ball,” 2006.
11. L. Gawronski, S. Mohammed, R. Pastor, and V. Prajapati, “Unmanned Surface Vehicle,” 2007.

**E. Undergraduate Student Research/Mentoring:**

- H. Wong and G. Yang: New York Space Grant Consortium, (6/99–8/00).
- J. Koo and I. Osei (Clarkson University): New York Space Grant Consortium, (6/02–8/02).
- S. Harari, I. Ahmed, and D.-Y. Ko (City University of New York): New York Space Grant Consortium, (5/03–8/03).
- S. Harari: Department of Homeland Security Scholar, (9/03–8/04).
- A. Panda: NSF RET Project (5/04–8/05).
- M. Salman and J. Wagh: New York Space Grant Consortium (5/04–8/05).
- B. Mak, V. Siderskiy, and I. Zenyuk: New York Space Grant Consortium (6/07–8/07).
- K.-K. Ching, J. Li., and D. Remiszewski: New York State Education Department (6/07–8/07).
- J. Frank and S. L. Wong: Polytechnic University (6/07–8/07).
- D. Remiszewski: New York State Education Department (9/07–10/07).
- B. Mak (9/07–12/07) and V. Siderskiy: New York Space Grant Consortium (9/07–5/09).
- J. Frank: New York Space Grant Consortium (6/09–8/09).
- R. Liao: ASTI (5/09–5/10).

- D. Lopez: New York Space Grant Consortium (5/10–5/11).
- J. L. Lin (Cornell University): unfunded (6/10–8/10).
- A. Ramkaran (Rensselaer Polytechnic Institute): unfunded (7/11–8/11).
- D. Lee: unfunded (6/12–8/12).
- V. Fernandes: unfunded (1/13–5/13); ARISE project (6/13–8/13).
- K. Gildea: unfunded (1/13–current).
- G. Teixeira (Mississippi State University and Brazil): unfunded (6/13–8/13)
- M. Alj-Hakim (École Nationale Supérieure des Arts et Métiers, France): unfunded (6/13–8/13)
- G. Lemoine-Scelles (École Nationale Supérieure des Arts et Métiers, France): unfunded (6/13–8/13)
- Thomas Hofmann (MCI Management Center, Innsbruck, Austria): unfunded (01/14–6/14)
- Miles Hume (Lewis and Clark College, Portland, OR): unfunded (06/14–08/14)
- Aatif Mohammed: unfunded (07/14–08/14)
- Abhijeet Agnihotri (Indian Institute of Technology, Patna): unfunded (05/15–07/15)
- Akshay Jha (Indian Institute of Technology, Guwahati): unfunded (05/15–07/15)
- Carolina Verri Resende (Johnson & Wales University and Brazil): unfunded (05/15–08/15)
- João Victor Nunes e Silva (University of Southern California and Brazil): unfunded (05/15–08/15)
- Ezra Idy and Gui Hui Lui: unfunded (6/16–8/16)
- Daniel Cem Celikbas (Istanbul University, Turkey): unfunded (7/16–8/16)
- Max Rudolph (Georgia Tech), Dominique Watt (Case Western): New York Space Grant Consortium (6/17–8/17)
- Burak Aksoy (Sabanci University, Turkey), Ahmed Benkraouda (UAE University), and Omar Benkraouda (UAE University): unfunded (6/17–8/17)
- Adeel Ahmad (National University of Science and Technology, Pakistan): unfunded (7/17–8/17)
- Iris Chen and Hyun Seok Shin: unfunded (6/17–8/17)
- Alexander Sung: unfunded (8/17–9/17)
- Ziyad Abouelenin (German University, Egypt): unfunded (02/18–07/18), B.S. Thesis
- Alan French (Carnegie Mellon University): New York Space Grant Consortium (6/18–8/18)
- Dhruv Gamdha (IIT Roorkee, India): unfunded (05/18–08/18)
- Albert Go (Massachusetts Institute of Technology): New York Space Grant Consortium (6/18–8/18)
- Brian Goldberg (Binghamton Univ.): unfunded (06/18–08/18)
- Hoon Jeong (NYU): unfunded (06/18–08/18)
- Omar Shams (German University, Egypt): unfunded (07/18–09/18)
- Ashlee Tiwari (IIT Kanpur, India): unfunded (05/18–08/18)
- Andy Zou (Binghamton Univ.): unfunded (06/18–08/18)

- Renu Karthick Rajaguru Jayanthi (PSG College of Technology, Coimbatore, India): unfunded (01/19–05/19), B.S. Project
- Gnanapoongkothai Annamalai (PSG College of Technology, Coimbatore, India): unfunded (01/19–05/19), B.S. Project
- John Giannopoulos (NYU): unfunded (06/19–08/19)
- Randy St. Louis (Harvard Univ.): unfunded (05/19–08/19)
- Chayan Rellan (Mahindra École Centrale, Hyderabad, India): unfunded (05/19–08/19)
- Jack M. Spiegler (Purdue): unfunded (05/19–08/19)
- Amin Shuaib (United Arab Emirates University): unfunded (06/19–08/19)
- Aoxue Wei (Kyoto University, Japan): unfunded (08/19–10/19)
- Jonathan Miles (University of Missouri, Columbia), NYU Tandon Summer Undergraduate Research Program (06/20–08/20)

**F. Visiting Graduate Student Research/Mentoring:**

- Alireza Pouretamad (The University of Kashan, Iran, Ph.D. candidate): unfunded (09/15–08/16)

**G. GK-12 Fellows Support and Mentoring:****G1. RAISE Project Undergraduate Fellows:**

1. A. Kadashev (Summer'04–Spring'05)
2. D.-Y. Ko (Summer'04–Spring'05)
3. D. Kurian (Summer'04–Spring'05)
4. F. Mudasir (Fall'04– Summer'05)
5. A. Nisonov (Summer'04–Spring'05)
6. E. Rosa (Fall'04–Spring'05)
7. M. Walia (Summer'04–Spring'05)
8. S. K. Yu (Summer'04–Spring'05)
9. I. Zarankin (Summer'04–Spring'05)
10. A. Zavlyanov (Summer'04–Spring'05)
11. D. Chen (Summer'05–Spring'06)
12. W. Kok (Summer'05–Spring'06)
13. R. J. McGee, Jr. (Summer'05–Spring'06)
14. E. C. Seidman (Summer'05–Spring'06)
15. C. H. Yiu (Summer'05–Spring'06)
16. M. Cwikla (Summer'06–Spring'07)
17. Y. M. Lau (Summer'06–Spring'07)



18. M. Pytel (Summer'06—Spring'07)

**G2. RAISE Project Graduate Fellows:**

1. S. Sobhan (Summer'04—Spring'06)
2. N. Yakubov (Summer'04—Spring'06)
3. A. Nisonov (Summer'05—Spring'06)
4. M. Walia (Summer'05—Spring'06)
5. C. C. Wilkins (Summer'05—Spring'07)
6. S. K. Yu (Summer'05—Spring'07)
7. I. Zarankin (Summer'05—Spring'06)
8. A. Zavlyanov (Summer'05—Spring'06)
9. W. Kok (Summer'06—Spring'07)
10. F. Mudasir (Summer'06—Spring'07)
11. E. C. Seidman (Summer'06—Spring'07)
12. A. Mannino (Summer'07—Spring'08)
13. A. Dimond (Summer'08— Summer'09)
14. V. Kopman (Summer'08—Spring'09)
15. C. Yuvienco (Summer'08—Spring'09)

**G3. AMPS/CBSI Project Graduate Fellows:**

1. N. Abaid (Summer'08—Spring'11)
2. P. J. Baker (Summer'08—Spring'11)
3. J. Haghpanah (Summer'08—Spring'12)
4. M. Hernandez (Summer'08—Spring'11)
5. D. Irving (Summer'08—Spring'11)
6. P. Khazron (Summer'08—Spring'10)
7. A. Kozak (Summer'08—Spring'09)
8. K. Williams (Summer'08—Spring'11)
9. K. Abdelnour (Summer'09—Spring'11)
10. C. Chen (Summer'09—Spring'11)
11. R. Eckhardt (Summer'09—Spring'10)
12. M. Pruna (Summer'09—Spring'10)
13. C. Yuvienco (Summer'09—Spring'12) and (Summer'12—Spring'13)—partial Fellow
14. R. Caeti (Summer'10—Spring'11)
15. E. Mamasheva (Summer'10—Spring'11)

16. R. Poveda (Summer'10—Spring'12)
17. I. Igel (Summer'10—Spring'12)
18. U. Koniges (Summer'10—Spring'12)
19. Z. Nishino (Summer'10—Spring'12)
20. A. Cave (Summer'11—Spring'12)
21. M. Galligan (Summer'11—Spring'12)
22. J. Hume (Summer'11—Spring'13)
23. S. Sangankar (Summer'11—Spring'12)
24. E. Suescun-Florez (Summer'11—Spring'13)
25. A. Faisal (Summer'11—Spring'12)
26. J. Laut (Summer'11—Spring'12)
27. R. Uddin (Summer'11—Fall'12)
28. G. Cunningham (Summer'12—Fall'12, Fall'13—Spring'15)
29. R. Le Grand (Summer'12—Spring'14)
30. J. Narain (Summer'12—Spring'13)
31. S. Roslyakov (Summer'12—Spring'14)
32. M. Trumpis (Summer'12—Spring'13)
33. M. Fevzi Ozaydin (Summer'12—Fall'12)
34. V. Mwaffo (Summer'12—Spring'15)
35. P. T Phamduy (Summer'12—Spring'15)
36. J. Muldoon (Summer'12—Spring'14)
37. J. Xiao (Summer'12—Fall'12)—partial Fellow
38. J. Frezzo (Summer'12—Spring'13)—partial Fellow and (Summer'13—Spring'15)
39. J. Cox (Summer'12—Spring'13)—partial Fellow and (Summer'13—Summer'14)
40. S. Mercurio (Summer'13—Spring'15)
41. Anthony Brill (Summer'14—Spring'15)
42. Henry Mandus Clever (Summer'14—Spring'15)
43. Matthew Moorhead (Summer'14—Spring'15)
44. Bethany Weber (Summer'14—Spring'15)
45. Kaid Shajrah (Fall'14—Spring'15)
46. David Diner (Fall'15—Spring'16)

## **5. SERVICE AND LEADERSHIP**

### **A. Professional Organization Membership/Committee/Service/Panel/Exhibit:**

- Lead Organizer: **NYU Tandon Annual Research Expo**, May 3, 2019. Led a team of NYU Tandon faculty, administration, and staff colleagues to plan, organize, and conduct the Annual Research Expo. Our team efforts produced a high visibility campus event featuring over 40 *selective* research/education demonstrations from many of our academic departments at the faculty, graduate, and undergraduate levels, as well as from our K-12 STEM initiative and cross-institutional projects. The event attracted over 500 attendees.
- Exhibitor: Two research exhibits were presented by the MCRL students at the NYU Tandon Annual Research Expo, May 3, 2019.
- Exhibitor: **Interactive AR/VR Research @ MCRL**. Two MCRL students demonstrated their research projects at the Opening Ceremony of the AR/VR Center on October 24, 2018, at the Brooklyn Navy Yard. These students additionally presented their demos at the NYC Media Lab event “Future Reality”, November 29, 2018, at the NYU Kimmel Center.
- Lead Organizer: **NYU Tandon Annual Research Expo**, April 27, 2018. Led a team of NYU Tandon faculty, administration, and staff colleagues to plan, organize, and conduct the Annual Research Expo. Our team efforts produced a high visibility campus event featuring 70 research/education demonstrations from many of our academic departments at the faculty, graduate, and undergraduate levels, as well as from our K-12 STEM initiative and cross-institutional projects. The event attracted over 500 attendees.
- Exhibitor: Several exhibits were presented by the MCRL students at the NYU SoE Annual Research Expo, April 27, 2018. The project “Decentralized Robot Swarm Smart-Control Interface” exhibited by Sai Prasanth Krishnamoorthy and Ezra Idy of MCRL won the second prize.
- Exhibitor: Interactive Engineering at the Fifth **U.S. National Science and Engineering Expo**, Washington, DC, April 6–8, 2018. Worked with university administrators, staff of the Communication and Marketing Office, K-12 STEM Education Center, and a team of faculty to plan NYU Tandon’s participation at the Expo. Coordinated a team of faculty, Director Center for K-12 STEM Education and one staff member, and 10 students to plan, develop, and present an exhibit that allowed Expo attendees to learn about cutting edge projects from robotic swarms, to medical technology, and the newest in AR/VR.
- Panelist: “**Connecting Pathways to College and Careers**” Panel NYC DoE Career and Technical Education, CTE Impact on Achievement, Professional Development Day. January 29, 2018.
- Spokesperson for Media Interviews: Supported the **IEEE Public Visibility Committee** by responding to media queries on technology related topics of contemporary interests (augmented/virtual/mixed-reality). Fall 2017.
- Panelist: “RET Site in Mechatronics and Robotics with Entrepreneurship and Industry Experiences,” Presented at the **RET Site Best Practices: Design, Implementation and Sustainability Panel**, 2017 NSF Engineering Education and Centers Grantees Meeting. October 30, 2017.
- Attendee: On October 12, 13, 2017, Prof. Kapila attended and participated in an NSF-sponsored workshop “**To Finalize the Planning for a National Pilot for an in AP® Engineering.**” The workshop was held at the University of Maryland, College Park. Prof. Kapila contribute to the meeting based on his years of experience promoting integration of hands-on STEM teaching and learning in K-12 environments.

- Lead Organizer: **NYU Tandon Annual Research Expo**, April 21, 2017. Led a team of NYU Tandon faculty, administration, and staff colleagues to plan, organize, and conduct the Annual Research Expo. Our team efforts produced a high visibility campus event featuring 70 research/education demonstrations from many of our academic departments at the faculty, graduate, and undergraduate levels, as well as from our K-12 STEM initiative and cross-institutional projects. The event attracted over 1,000 attendees.
- Exhibitor: Several exhibits were presented by students from Dr. Kapila's Mechatronics, Controls, and Robotics Lab at the NYU Tandon Annual Research Expo, April 21, 2017. In addition, many exhibits were presented as part of the display by the Center for K-12 STEM Education.
- Board Member: **Engineering, Architecture, and Robotics Commission**, Career and Technical Education Program, New York City Department of Education. September 2016—current.
- Presenter and Exhibitor: **NYU HealthTech2016—Apps, Gadgets, and Gizmos**, May 7, 2016. Led a team of Mechatronics and Control Lab students to present "Mechatronics and Robotics Devices for Disabilities." Presented a 5-minute lightning talk and showcased our lab's work on CAESAR, The Humanoid Robot for Human-Robot Interaction Research and Gaming-based Stroke Rehabilitation Devices. The conference was a collaborative effort involving faculty from NYU Steinhardt (Occupational Therapy, Nutrition and Food Studies), Global and Public Health, NYU Ability Lab, and the University Council on the Study of Disability.
- Lead Organizer: **NYU Tandon Annual Research Expo**, April 27, 2016. Led a team of NYU Tandon faculty, administration, and staff colleagues to plan, organize, and conduct the Annual Research Expo. Our team efforts produced a high visibility campus event featuring 57 research/education demonstrations from many of our academic departments at the faculty, graduate, and undergraduate levels, as well as from our K-12 STEM initiative and cross-institutional projects. The event attracted over 1,000 attendees.
- Exhibitor: Three exhibits were presented by students from Dr. Kapila's Mechatronics and Robotics Lab at the NYU Tandon Annual Research Expo, April 27, 2016. In addition, many exhibits were presented as part of the display by the Center for K-12 STEM Education. The K-12 STEM Center exhibit received the Best Departmental Exhibit Award.
- Exhibitor: Learning with Robots, Games, and Biologics at the Fourth **U.S. National Science and Engineering Expo**, Washington, DC, April 15—17, 2016. Worked with university administrators, staff of the Communication and Marketing Office, and a team of faculty to plan NYU Tandon's participation at the Expo. Led a team of four faculty, Director Center for K-12 STEM Education and one staff member, and 11 graduate students and 1 undergraduate student to plan, develop, and present an exhibit that allowed Expo attendees to connect with science, math, and engineering concepts through interactive exhibits to learn about advances in engineering, robotics, digital games, and K-12 STEM education.
- Lead Organizer: **NYU-SoE Annual Research Expo**, April 24, 2015. Led a team of NYU-SoE faculty, administration, and staff colleagues to plan, organize, and conduct the Annual Research Expo. Our team efforts produced a high visibility campus event featuring 55 research/education demonstrations from many of our academic departments at the faculty, graduate, and undergraduate levels, as well as from our K-12 STEM initiative, cross-institutional projects, the Media Lab, and companies from our thriving Incubators. The event attracted over 1,000 attendees.
- Member, International Program Committee, International Conference on Informatics in Control, Automation and Robotics, France, July'15 and Lisbon, Portugal, July'16.
- Member: International Program Committee, Indian Control Conference, Chennai, India. January'15; Hyderabad, India, January'16; and Guwahati, India, January'17.

- Exhibitor: Five exhibits were presented by students from Dr. Kapila's Mechatronics and Robotics Lab at the NYU-SoE Annual Research Expo, April 24, 2015. In addition, many exhibits were presented as part of the display by the Center for K-12 STEM Education. Prof. Kapila's students (J.A. Frank, J.A. Gomez, and A. Sharma) won the first prize based on the votes of external judges for their project "**Making Faces with CAESAR: Teaching Emotions to Expressive Humanoid Robots.**"
- Lead Organizer: **Liberty Science Center Event Robotics Exhibit** from the NYU Polytechnic School of Engineering. Worked with a faculty colleague, Director of the Center for K-12 STEM Education, and six graduate students to present an exhibit. This was in response to a "Special Invitation: Genius Gala 3.0 at Liberty Science Center." The event was held in Jersey City, NJ, on May 9, 2014 to recognize Craig Venter (genome guru and entrepreneur); Sylvia Earle (National Geographic's Explorer-in-Residence and a world-renowned oceanographer); and Dean Kamen (a serial inventor and entrepreneur). The invitation to Prof. Kapila states: "... we are impressed with your work in robotics at NYU Polytechnic School of Engineering and would like to invite you to attend with your interactive robots to bring the excitement of Robotics to our guests throughout the evening. It is an exciting opportunity, especially as we honor Dean Kamen, a pioneer of robotics education and Founder of First Robotics."
- Lead Organizer: **NYU-SoE Annual Research Expo**, May 2, 2014. Led a team of NYU-SoE faculty, administration, and staff colleagues to plan, organize, and conduct the Second Annual Research Expo. Our team efforts produced a high visibility campus event featuring over 45 research demonstrations from many of our academic departments at the faculty, graduate, and undergraduate levels, as well as from our K-12 STEM initiative, cross-institutional projects, the Media Lab, and companies from our thriving Incubators.
- Exhibitor: **Intuitive Interaction with Mobile and Humanoid Robot**, at the NYU-SoE Annual Research Expo, May 2, 2014. Several engineering students from Professor Kapila's Mechatronics Lab showcased "Development of intuitive interfaces for human - robot interaction." This exhibit received the First Prize based on the voting by the Expo attendees. Moreover, the Mechanical and Aerospace Engineering Department's collection of exhibits were judged to be the Best Departmental Exhibit based on the voting by the Expo attendees.
- Exhibitor: **Interactive Technologies by using Mechatronics and Robotics**, at the NYU-SoE Annual Research Expo, May 2, 2014. Several students from Professor Kapila's Advanced Mechatronics course showcased three interactive mechatronics projects.
- Panel Moderator: **Industry, Workforce Needs and How to Partner with K-14**, NSF RET Workshop, April 28, 29, 2014, Arlington, VA. Panelists included: Elaine Franklin, Director, Kenan Fellows Program; Jessica Uelmen, Director of Strategic Operations, Parallax; and Jeff Branson, Educational Outreach Coordinator, Sparkfun.
- Exhibitor: **Learning with Robots and Games** at the *Third U.S. National Science and Engineering Expo*, Washington, DC, April 25–26, 2014. Worked with university administrators, staff of the Development Office and Communication and Marketing Office, and a team of faculty to plan NYU-SoE's participation at the Expo. Led a team of three faculty, Director Center for K-12 STEM Education, and 14 graduate students to plan, develop, and present an exhibit that allowed Expo attendees to connect with science, math, and engineering concepts in an exciting way. Visitors engaged with our interactive exhibits to learn about advances in engineering, robotics, digital games, and K-12 STEM education.
- Exhibitor: **Mobile Apps for Robotics** at the Innovation Square, an event held at NYU-Poly as part of the World Science Festival, June 1, 2013. The event was attended by over 1,000 K-12 teachers, students, STEM professionals, and general public.

- Panelist: ***STEM is the New Space Race***, The Greene Space, New York, NY, May 21, 2013. Served as a panelist with co-panelists: Josh Thomases, Deputy Chief Academic Officer, NYC Department of Education and Saranii Muller, Teacher, Fort Greene Preparatory Academy. Moderator: Manoush Zomorodi, host of WNYC's New Tech City. Organizers: WNYC'S SchoolBook and NYU-Poly.
- Exhibitor: ***Mobile Apps for Intuitive Human-Robot Interaction***, at the NYU-Poly Inaugural Research Expo, May 20, 2013. Three engineering students from Professor Kapila's Mechatronics Lab exhibited the following projects at the Expo: (1) Mobile Apps to facilitate intuitive interaction between an operator and a mobile robot with a 3 d.o.f. manipulator; (2) CAESAR, a humanoid robot-head that can engage with people by following their moving faces; and (3) A wearable interface to control a robotic manipulator. This exhibit received the First Prize based on the voting by the Expo attendees. Moreover, the Mechanical and Aerospace Engineering Department's collection of exhibits were judged to be the Best Departmental Exhibit based on the voting by the Expo attendees.
- Panelist: ***Makers, DIY and Video Games: Self-Directed Learning in the NGSS Classroom***, Rockefeller University, New York, NY, March 9, 2013. Co-Panelists: Aileen Mitchell, Principal, MS88; Sean Cusack, President and CEO at Learnosaurus; Dustyn Roberts, PhD Candidate, Polytechnic Institute of NYU; Jennifer Childress, PhD, Senior Advisor, Achieve Inc. Moderator: Ben Esner, NYU-Poly. Organizers: Rockefeller University, The New York Academy of Sciences, and NYU-Poly.
- Exhibitor: ***Mobile Apps for Robotics*** at the Second U.S. National Science and Engineering Expo, Washington, DC, April 27–29, 2012. Our showcase was one of only 16 NSF-funded research and education projects selected by NSF to be featured at the event. The project team, including Dr. Kapila, four Mechatronics Lab graduate students, and a teacher interacted with over 3,000 Expo attendees. Our exhibit allowed the Expo attendees to learn about advances in human-robot interaction technology through an engaging and educational mobile robot project. The Expo attendees explored and experienced innovative uses of pervasive communication and computing iDevices (e.g., iPhone, iPod, and iPad), to intuitively interact with robots by exploiting on-board sensors, rich graphics, and touch, gesture, and sound recognition capabilities of iDevices.
- Exhibitor: ***Learning with Robots and Games*** at the Second U.S. National Science and Engineering Expo, Washington, DC, April 27–29, 2012. Worked with university administrators, staff of the Development Office and Communication and Marketing Office, and a team of faculty to plan NYU-Poly's participation at the Expo. Led a team of four faculty, Director Center for K-12 STEM Education, 14 graduate students, and one K-12 teacher to plan, develop, and present an exhibit that allowed Expo attendees to connect with science, math, and engineering concepts in an exciting way. More than 5,000 visitors engaged with our interactive exhibits to learn about advances in robotics, biomimetics, and digital games.
- Panelist: ***Bridging the Achievement Gap: The Power of Science***, NYC Youth Funders, New York, NY, February 9, 2012. Co-Panelists: Meghan Groome (Director, K-12 Education and Science & the City, The New York Academy of Sciences) and Gregg Bethel (Executive Director, School Programs and Partnerships, New York City Department of Education). Moderator: Preeti Gupta (Director, Youth Learning and Research, American Museum of Natural History).
- Member: Editorial Board, International Journal of Online Engineering, January 2012–current.
- Panelist: ***Leveraging Local Scientific Resources for Education***, New York Academy of Sciences, New York, NY, July 14, 2011 (part of NYU-Poly's Summer Institute for Educators). Co-Panelists: Ben Esner (NYU-Poly) and Samantha Freeman (Director, Harlem Ivy Program). Moderator: Meghan Groome (Director, K-12 Education and Science & the City, The New York Academy of Sciences).

- Panelist: **Best Practices for Pre-College Outreach and Curriculum Partnerships—Bridging Research and Practice**, NSF Engineering Education Grantees Annual Meeting, Reston, VA, March 15, 2011. Led the panel with “Impact of an RET Site” presentation. Co-Panelists: Claire Duggan (Northeastern University) and Jacquelyn Sullivan (University of Colorado, Boulder).
- Panelist: **How to Keep GK-12 Thriving at Your University**, NSF GK-12 Fellows Program Annual Meeting, Washington DC, March 12, 2011. Led the panel with “Sustaining a GK-12 Fellows Project” presentation. Co-Panelist: Douglas Levey (University of Florida).
- Organizer: **Engineers Week Celebration** at the Rockefeller Plaza. On February 20, 2011, more than 3.8 million viewers tuned into the Sunday NBC Today Show to see Rockefeller Plaza filled with robots and signs proclaiming, NYU-Poly Celebrates Engineers Week. Our team included over 50 members (including faculty, 30+ students, two graduate Fellows, 5 teachers from 4 schools, parents, members of NYU-Poly’s media and development office, and a staff member of the Brooklyn Community Foundation, the founding sponsor of CBRI). Janice Huff, NBC weather reporter, interviewed project teacher Ms. Tanya Wardally and a student. The interview aired on the Today's Show (around 9:30am, local time).
- Exhibitor: **Mechatronics Mania** at the U.S. National Science and Engineering Expo, Washington, DC, October 23–24, 2010. Our showcase was one of only 15 NSF-funded research and education projects selected by NSF to be featured at the event. Over 2,500 visitors interacted with our exhibit staff. On October 22, 2010, we presented a showcase at a VIP reception, organized by NYU-Poly and hosted by a trustee of the university, at which various sponsors of the project were recognized. Moreover, on October 23, 2010, the project team presented a showcase at an Alumni reception. The Mechatronics Mania exhibit was also presented at: i) the 2011 Sci-Ed Innovators Expo and Symposium at the New York University, New York, NY, February 7, 2011 (attended by over 400 K-12 teachers, students, and STEM professionals); ii) NASA Expo “What's Your Favorite Space?” New York, NY, August 18, 2011 (attended by over 3,000 K-12 students, teachers, and general public); and iii) Maker Faire, held at the New York Hall of Science, Queens, NY, September 17 and 18, 2011 (attended by over 10,000 students, teachers, and general public).
- Panelist: **Teaching Mechatronics**—A Panel on Multidisciplinary Learning and its Relevance to Industry, *Amer. Soc. Eng. Ed. Annual Conf. and Expo.*, Session 1566, Louisville, KY, 2010.
- Panelist: **Institutionalization and Sustainability**, NSF GK-12 Fellows Project Annual Meeting, Washington, DC, March 28, 2009.
- Technical Program Chair: International Conference on Engineering Education, Instructional Technology, Assessment, and E-learning, 2008 and 2009.
- Corresponding Editor: New Products Column, *IEEE Control Systems Magazine* (07/2005–02/2008).
- Senior Member: IEEE.
- Member: ASME, AIAA, and ASEE.
- Member of Electoral College: ASME Dynamic Systems and Control Division (2017–current).
- Affiliate Director: NASA/New York Space Grant Consortium (1998–Present). Represent NYU-SoE at the NASA/New York Space Grant Consortium’s advisory meetings.
- Attended, by invitation, Strategies for Engineering Education K–16 (SEEK–16) Summit at the National Academy of Engineering, Washington, DC, February 2005.
- Member: Review panel for the best student paper award for the *IEEE Conf. on Dec. and Contr.* (2003, 2000, and 1999).

- Member: Program Committee of the 42<sup>nd</sup> IEEE Conference on Decision and Control, December 2003, Maui, Hawaii.
- Attended, by invitation, the IFAC sponsored Internet Based Control Education Workshop, December 2001, Madrid, Spain.
- Attended, by invitation, the NASA GSFC GN&C Formation Flying Testbed System Architecture Review, Greenbelt, MD, June 2000.
- Invited to the AFRL TechSat 21 review meeting by Orbital Research Inc. (SBIR contractor), April 2000. Attended meeting and made a technical presentation along with the Orbital Research Inc. team.
- Vice-Chair: Aerospace Control Panel of Dynamic Systems and Control Division of ASME (1998–2000).

### **B. Reviewer for:**

- Book Review—Atmospheric and Space Flight Dynamics by A. Tewari, Birkhauser, Boston, MA, 2007, (Pre-publication).
- The U.S. National Science Foundation (**Committee of Visitors**, Site Visits, Panels, *Ad hoc* reviews, etc.)
- Center for the Advancement of Science in Space (CASIS) (review panel)
- Energy Innovations Small Grant Program, San Diego State University Foundation (*ad hoc* reviews)
- Sloan Awards for Excellence in Teaching Science and Mathematics, New York City (2009–2016)
- Computing Surveys
- IEEE Robotics and Automation Letters
- IEEE Transactions on Automatic Control
- IEEE Transactions on Control System Technology
- IEEE Transactions on Robotics
- International Journal of Control
- International Journal of Systems Science
- International Journal on Robust and Nonlinear Control
- ASME Journal of Dynamic Systems, Measurement, and Control
- AIAA Journal of Guidance, Control, and Dynamics
- Automatica
- Journal of Franklin Institute
- Journal of Optimization Theory and Applications
- Journal of Vibration and Control
- Robotica
- Systems and Control Letters
- American Control Conference
- ASEE Annual Conference IEEE Conference on Decision and Control



- ASME International Mechanical Engineering Congress and Exposition
- ASME Conference on Engineering Systems Design and Analysis
- IEEE Engineering in Medicine and Biology Society Conference
- IEEE Industrial Electronics Society Conference
- International Conference on Robotics and Automation
- IEEE/RSJ International Conference on Intelligent Robots and Systems
- IEEE Indian Control Conference
- International Conference on Informatics in Control, Automation and Robotics
- Many other journal and conference venues

**C. Departmental Service:**

- Conducted numerous tours for department/university visitors to the mechatronics, controls, and robotics laboratory.
- Member: NYU Tandon, Faculty Search committee, Mechanical and Aerospace Engineering, September 2018–March 2019.
- Chair/Member (*Ad hoc* Promotion/Reappointment Committees): Service on various departmental-level *ad hoc* tenure and promotion committees (multiple years, ongoing).
- Member: Robotics Joint Faculty Search committee, Mechanical and Electrical Engineering, fall 2017–spring 2018 and fall 2016–spring 2017.
- Member: Mentoring committee, Prof. Weiqiang Chen, fall 2014–current.
- Member: Faculty Search committee, Mechanical Engineering, fall 2014–spring 2015.
- Chair: Faculty Search committee, Smart systems and materials (Dynamical Systems), fall 2014–spring 2015.
- Chair: Faculty Search committee, Smart systems and materials, fall 2013–spring 2014.
- Member: Department Strategic Planning Committee, summer 2013–fall 2013. Contributed to planning, writing, and implementing the strategic plan. Developed the SWOT analysis. Led the subcommittee on faculty hiring component of strategic plan. Contributing to the M.S. program subcommittee by leading a group of faculty colleagues to propose a new M.S. program in Mechatronics and Robotics (on-going).
- Member: Faculty Search committee, The Eugene Kleiner Chair for Innovation in Mechanical Engineering, summer 2011–spring 2013.
- Coordinator: Department Ph.D. Qualifying Exam, summer 2010–summer 2017.
- Member: Mentoring committee, Prof. Maurizio Porfiri, fall 2009–spring 2011.
- Chair: Faculty Search committee, Controls and Dynamical Systems, fall 2008–spring 2009.
- Member: Faculty Search committee, Mechanical Engineering, spring 2008.
- Chair: Faculty Search committee, Dynamic Systems and Control, spring 2005–spring 2006.
- Member: Faculty Search committee, The Eugene Kleiner Chair for Innovation in Mechanical Engineering, spring 2005–spring 2006.

- Organizer: Departmental Seminar Series, fall 2002.
- Member: Faculty Search committee, Control and Robotics, spring 2001.
- Member: 4×4-curriculum committee 2000 and 2001.
- Member: Ph.D. qualifier committee, 1999—current.
- Faculty Advisor: Polytechnic chapter of Pi-Tau-Sigma honor society, 1999, 2000.
- Organizer: Control Systems (I, II, and III), ME 100 Symposium, Brooklyn, NY, November 1999.
- Member: Search committee for Visiting Professor, Controls, 1998.
- Assisted in graduate student advising.
- Assisted undergraduates with NASA/NY Space Grant summer program.
- Advised undergraduates under NASA/NY Space Grant summer program.
- Assisted in new graduate student recruiting by advertising graduate programs and available assistantships on the web, by direct mail to prestigious universities, and by visiting department heads at several institutions (on personal trips).

**D. University/Institution Service:**

- Inaugural Director of the **Ph.D. Professional Development Program**, January 2020—current: Planned and piloted a series of eight two-hour workshops by recruiting external speakers in fall 2020 for engineering doctoral students on mentoring, dissertation progress, decision-making and leadership, storytelling and emotional intelligence to land a grant/job, etc. In spring'2021, two workshops tracks will be offered: (1) Success in Ph.D. Process and (2) Leadership in and beyond Academia. Each track will host eight to nine sessions of two hours long workshops. The experience from these workshops will help create a professional development certificate program for doctoral students.
- **Faculty Coordinator (Evangelist) for Graduate Research Fellowship Program (GRFP), Fall 2018—current:** Researched and analyzed the competitive landscape of graduate fellowships in general and NSF's GRFP in particular. Recruited a graduate assistant to develop and launch a website to disseminate information about various fellowship opportunities. Conducted five informational workshops for recruiting potential applicants for the NSF GRFP (fall 2019 cycle). Developed a collaborative partnership with the Office of the Associate Dean of Academics to identify and communicate with potentially qualified applicants. The effort is now supported by one faculty lead from each of the five engineering/computing departments (CBE, CSE, CUE, ECE, and MAE). Moreover, two faculty colleagues (from TCS and TMI) have been recruited to conduct writing workshops and provide one-on-one coaching to applicants in preparing their GRFP applications. The project website is available at: <https://engineering.nyu.edu/fellowops/>.
- Member: **NYU Dissertation Prize Committee**, October 2018—current.
- Member: **NYU Tandon Dean Search Committee**, September 2017—February 2018.
- Member: Committee on Entrepreneurship and Innovation (NYU Tandon), summer 2017.
- Member: Search Committees for the K–12 STEM Center Assistant Director and Project Manager, spring 2017—fall 2017 and spring 2019.
- Member, NYU Provost's Faculty Advisory Committee on Academic Priorities, September 2016—August 2018.

- Member, **Search Committee for the New York University Provost**, September 2015—Spring 2016.
- Member: Mentoring Committees for several Assistant Professors (CUE, ECE, etc.). Ongoing.
- Partnered and collaborated with Associate Dean of Academic Administration to plan and organize a workshop “Active Learning Strategies in Engineering.” The workshop was conducted by Rebecca Brent and Richard M. Felder, with international renown for their teaching workshops. The workshop was held at NYU Tandon on February 19, 2016 and it was attended by well over 50 NYU Tandon faculty.
- Collaborated with the Vice Dean for Research and Associate Dean of Academic Administration, to conceive, plan, and conduct advising and mentoring sessions for recently recruited assistant professors to support their **Career Proposal preparation**. Prior winners of NSF Career Award and highly successful grantees participated to provide feedback. (Spring 2015, Spring 2016, Spring 2017) Illustrative outcome: **Six assistant professors from various NYU Tandon departments won the NSF Career Award in 2018.**
- Collaborated with the Associate Dean of Academic Administration, to plan and conduct advising sessions for recently recruited assistant professors to provide an overview of the Tenure and Promotion process to support their progress towards reappointments, tenure, etc. (fall’14—summer’17).
- **Speaker of the Faculty of NYU Tandon** (fall 2015—summer 2017) and Speaker-Elect: Faculty of NYU-SoE, fall 2014 (elected). In my role as the Speaker, I called on the NYU-SoE faculty to examine our research and curricula enterprise and recommend strategies for enhancements. In consultation with faculty and administration, I formed a committee on Research and a committee on Undergraduate Curriculum. These committees’ reports were completed and submitted at the end of spring 2016 and have been critical in informing NYU-SoE’s strategic planning exercise (2016—2017). To enhance research, we are undertaking a multifaceted approach: creating mentoring and feedback structures for starting faculty to succeed in building high impact research; nurturing interdisciplinary, across school collaborations (e.g., with Medicine, Education, etc.); and identifying strategic opportunities to align NYU-SoE research strengths with external partners for partnerships, leading to large-scale, center-level research in two to three areas. Similarly, to enhance undergraduate curriculum, we are seeking to integrate project-based learning, interdisciplinary training, practical educational experiences through maker-based curricula activities, entrepreneurship, etc. In 2016-17, in consultation with faculty and administration, I charged our faculty to examine and act on two issues, Retention and Graduation Rates and Affordability. The interim reporting of these committees is informing the implementation phase of our strategic plan. For the fall 2017-summer 2018 period, I served as the Past-Speaker. In this role, I continued to serve on the Faculty Executive Committee and supported the Speaker as needed.
- **Chair: Tenure and Promotion Committee** (TPC), NYU-SoE, November 2012—August 2015, (elected—November 2012, November 2013, and November 2014).
- Ex-Officio Member: **Financial Policies Committee**, NYU-SoE, fall 2015—current (The Speaker of Faculty serves as an ex-officio member of this shared governance committee).
- Member: **Faculty Executive Committee**, NYU Tandon, fall 2012—current, (elected).
- Member: NYU Tandon Tenure and Promotion Committee, fall 2011—2016, (elected fall 2011 for a two-year term, summer 2013 for a three-year term, and spring 2016 for a one-year term). Served one term (2017-18) as a nominee of the Dean of Engineering.
- Speaker: NYU-SoE K-12 STEM Programming, Southeastern Florida Alumni Chapter Gathering, Delray Beach, FL, February 25, 2014. The event was led by Valerie Cabral, Director of Alumni Relations.

- Faculty lead: Ribbon Cutting Robot for the event celebrating the merger of NYU-Poly and NYU, January 30, 2014. Prof. Kapila's students in the Mechatronics and Control lab repurposed a research robot and developed an Android App for the robot that performed the official ribbon cutting.
- Organizer: Introduction to Robotics, NYU Alumni Day, Washington Square, NYC, October 19, 2013. Led a team of five graduate students to conduct a 90 minute robotics workshop for NYU alumni. In addition, provided robotics demonstrations at the School of Engineering Dean's luncheon reception for the alumni.
- Co-Host: Poly Alumni Events in Florida. Professor Kapila and graduate student J. A. Frank co-hosted a series of Alumni events in Orlando, Naples, and St. Lucie (February 10–12, 2012) to support the NYU-Poly Office of Development. At the various event sites, Prof. Kapila, Mr. Frank, and Kim Mackley (NYU-Poly Development and Host) were joined by the following NYU-Poly personnel: Jerry M. Hultin (President), Erica Marks, and Lorna Malcolm-Lessard. Prof. Kapila and Mr. Frank interacted with the attendees, answered their questions about NYU-Poly, and provided experimental demonstration of their Mobile Apps for Robotics.
- Organizer: A showcase of several mechatronics lab research and education projects at the 2011 Promise Fund Event, NYU-Poly, June 15, 2011.
- Member: K–12 Director Search committee, summer 2010—spring 2011.
- Member: Laboratory sub-committee of NYU-Poly's Space committee, fall 2009—spring 2011.
- Member: Teaching Awards Committee, spring 2009 and spring 2010.
- Member: Vice President for Research & Technology Initiatives Search Committee, spring 2006 (one of 4 faculty representatives).
- Chair: 2005 Distinguished Teacher Award Committee, spring 2005.
- Member: **Presidential Search Committee**, summer 2004—spring 2005 (one of 4 faculty representatives).
- Member: 2004 Distinguished Teacher Award Committee, spring 2004.
- Member: Undergraduate Curriculum and Standards Committee (UGCSC), fall 2003—fall 2010.
- Member: Math Assessment Team, fall 2002.
- Faculty Mentor: Over 100 high school students.
  - i)* Mentored five high school students who worked with Mechatronics lab researchers to contribute to projects such as: i) an AR interface on iPad for supervision of swarm robot locations obtained via the tag-based localization system; ii) an adaptive support system for stroke patients; and iii) a method to localize and identify agents and obstacles in a distributed swarm system; among others.
  - ii)* Mentored five high school students who worked with Mechatronics lab researchers to contribute to projects such as: i) a hand rehabilitation device for stroke patients; ii) a device to assist stroke patients to practice finger extension/flexion movement; iii) an instrumented wearable jacket to sense the range of motion of the arms of a person to aid in the recovery of stroke patients; iv) integration of vision, augmented reality, robot operating system (ROS), and mobile devices for low-cost, efficient identification and localization of agents in a robotic swarm; v) an instrumented smart syringe for precise drug-delivery at specific locations exhibiting increased muscle stiffness; and vi) an expressive humanoid robot (June 2017-August 2017).
  - iii)* Mentored five high school students who worked with Mechatronics lab researchers to contribute to projects such as: designing a jacket with modularity to host sensing, computing,

and communication components; integrating Raspberry PI, ROS, and Ubuntu for an augmented reality robotics framework; and mobile app applications. July 2016–August 2016.

- iv) Mentored five high school students who worked with Mechatronics lab researchers to contribute to projects such as: prototyping and testing a system to analyze hand and arm motion of a human subject and prototyping and testing an indoor navigation device for visually impaired. July 2015–August 2015.
  - v) Mentored three summer research students who worked with Mechatronics lab researchers on projects such as: Blocks-based Visual Environment to Teach Robot-programming to K-12 Students, Object Search by a Swarm of Robots, Mimicking Robotic Arm, etc. July 2014–August 2014.
  - vi) Mentored five summer research students who worked with Mechatronics lab researchers on projects such as: Design and Construction of Torso for an Expressive Robotic Head, Design and Prototype of an Exoskeleton for a Robotic Arm to Measure Joint Angles, Design and Prototype of a Human-like Robot Arm, etc. June 2013–August 2013.
  - vii) Mentored five summer research students who worked with Mechatronics lab researchers on projects such as: Expressive Robotic Head, Grip Assisting Glove, and Robotic Stingray. June 2012–August 2012.
  - viii) Under the *Environmental Mechatronics Summer Project*, from July 19–22, 2011, 15 local high school students learned about electronics, sensors, microcontrollers, and programming to develop a prototype device for an environmental monitoring project, specifically air humidity, temperature, soil moisture level, etc. The students installed and tested their devices in Lentol Garden, located in Greenpoint Brooklyn. Ten local high school students attended a similar program from July 17–20, 2012.
  - ix) Polytechnic’s 7 weeklong Youth in Engineering and Science (YES) summer research program for high school students (2005: 11, 2004: 13 students, 2003: 7 students, 2002: 10 students, 2001: 9 students, 2000: 7 students).
  - x) NASA’s 8 weeklong SHARP summer internship program (2005: 2 students; 2004: 2 students, 2003: 2 students).
  - xi) New York Academy of Sciences’ 8 weeklong Summer Science Research Training Program (2004: 1 student).
  - xii) New York City Board of Education Executive Intern program (spring 2004: 1 student, spring 2002: 1 student, and fall 2001: 1 student).
- Member: Quality Learning Environment Team of Campaign 1-2-3, fall 2001–spring 2004.
  - Coordinator: YES program, M.E. department, 2001.
  - Faculty Mentor: First Robotics team from Manhattan Center for Science and Math, spring 2001.
  - Member: Academic Computing Committee 2000, 2001.

#### **E. Other Activities and Interactions:**

- Prepared experimental control exhibits for 1998–2017 open houses.
- Prepared experimental control exhibits for the ABET evaluations (since 1999 for each ABET visit).

#### **F. Teaching Seminars and Academic Workshops Attended:**

- Attended, Improving Faculty Diversity: Best Practices and Effective Strategies, Susan Metz (Executive Director of Diversity and Inclusion and Senior Research Associate, Stevens Institute of Technology). NYU-SoE, February 2017.

- Attended, Active Learning Strategies in Engineering, Rebecca Brent and Richard M. Felder. NYU-SoE, February 2016.
- Attended, by invitation, “Expanding and Scaling Innovative Digital Fluency Models,” organized by STEMconnector and Tata Consultancy Services, September 15, 2015, New York, NY.
- Attended, by invitation, the SCIENTIFIC AMERICAN’S Annual Executive STEM Summit: The Future of Education, August 4, 2015, New York, NY.
- Attended, on behalf of NYU-SoE, The White House College Opportunity Initiative: STEM Education Workshop, Florida International University, Miami, FL. October 1, 2014.
- Attended, by invitation, the SCIENTIFIC AMERICAN’S Annual Executive STEM Summit: *Science of Learning*, August 5, 2014.
- Attended, by invitation, a panel discussion event “Innovation in STEM Education—400,000 Hours of Practice,” by editors and authors of a newly released edited volume *Einstein Fellows: Best Practices in STEM Education*, Woodrow Wilson International Center for Scholars, Washington D.C., July 22, 2014.
- Attended, by invitation, the SCIENTIFIC AMERICAN’S Annual Executive STEM Summit: *Learning in the Digital Age*, August 7, 2013.
- Attended a seminar “Creating Goal Based Scenarios,” by Ken Bain, Director of the Teaching and Learning Resource Center, Montclair State University, (February 21, 2007, Polytechnic University).
- Attended a seminar “Developing Great Lectures,” by Ken Bain, (November 15, 2006, Polytechnic University).
- Attended, by invitation, *Strategies for Engineering Education K–16 (SEEK–16) Summit* at the National Academy of Engineering, Washington, DC, February 21-22, 2005.
- Participated in ABET 2000 workshops at Polytechnic University.
- Participated in a workshop on teaching, August 25–27, 1997, Polytechnic University.
- Participated in a workshop on combating cheating, April 4, 1997, Polytechnic University.
- Participated in a Gateway Coalition Workshop: “Assessing active learning and alternative classroom modes to enhance student learning,” Polytechnic University.

**6. HONORS**

1. Nominated and selected to attend the ***Eighth Annual Frontiers of Engineering Education Symposium*** of the ***National Academy of Engineering***, September 25–28, 2016, Irvine, CA.
2. Awarded a ***Certificate of Excellence*** with citation “In recognition of a longstanding partnership and commitment to the students of New York City’s Career and Technical Education (CTE) Programs and Schools.” February 2016.
3. NYU Tandon’s Mechatronics and Control Lab has been designated as “Quanser Center for Excellence” by Quanser Consulting, Inc., Canada. Fall 2015.
4. Invited by the ***Research Experience for Teachers*** (RET) Site Program of the National Science Foundation to participate in a Panel at the NSF STEM Forum. V. Kapila and J. Jadav (RET alumni), NSF STEM Forum, Washington, DC, November 9, 2015. “Lessons from a Research Experience for Teachers Site.”
5. Received the ***2014 Ray H. Spiess Award*** given annually to the outstanding ***ASEE CoED Journal*** paper on mobile teaching aids and computation techniques. J. Laut, V. Kapila, and M. Iskander, “Exposing Middle School Students to Robotics and Engineering through LEGO and Matlab,” ***ASEE Computers in Education Journal***, Vol. 5, No. 3, 2–13, 2014.
6. Received a ***2015 NYU Distinguished Teaching Award***. Dr. Kapila was nominated as a candidate for the award by an *ad hoc* committee of NYU-SoE faculty. The award consists of a medal and a grant of \$5,000 to be expended at the discretion of the recipient.
7. Received a ***2014 Jacobs Excellence in Education Award*** at NYU-SoE. The award citation reads in part “Your courses are held in high esteem, and your students appreciate ... the professionalism with which you treat them. Your exemplary dedication to education extends beyond the traditional classroom. ... You are selfless regarding the needs of your students, who are privileged to have you as their mentor. Your colleagues ... are proud to count you as one of their own....” The award carries a grant of \$10,000 to be expended at the discretion of the recipient.
8. Invited by the ***Research Experience for Teachers*** (RET) Site program personnel at NSF to attend an important workshop to discuss best practices and future directions of the NSF RET in Engineering and Computer Science program. The workshop was conducted on April 28 and 29, 2014. Prof. Kapila collaborated with the RET program personnel at NSF in the planning of the workshop, including inviting participants from K-12 schools, colleges, and industry. Moreover, he presented a plenary talk on NYU Polytechnic School of Engineering K-12 STEM Education programming and model.
9. Invited to serve as a ***Member of the Advisory Board*** for ***America’s Amazing Teen Project***, an online competition to identify, honor, and mentor exceptional teens whose discoveries will change the world. The project is receiving support from UPenn, Stanford, MIT, Harvard, Yale, Dartmouth, and NYU, among others.
10. Received NYU-Poly’s Inaugural ***Distinguished Award for Excellence*** in the category ***Inspiration through Leadership***, October 2012.
11. Invited to the ***U.S. National Science and Engineering Expo***, Washington, DC, April 27–29, 2012. Our showcase “Mobile Apps for Robotics,” was one of only 16 NSF-funded research and education projects selected by NSF to be featured at the event.
12. Invited to an NSF/AAAS workshop (October 21, 22, 2011) to develop a ***GK-12 How to Guide***. The Guide was expected to have 12 chapters organized into three sections. Prof. Kapila was invited by the NSF GK-12 Program Manager to coordinate the section on “Sustaining GK-12 Program.” From fall 2011–spring 2012, Prof. Kapila collaborated with the national GK-12 community to coordinate

chapters titled: Evaluating Projects (Chapter 9); Communicating Project Success (Chapter 10); Sustainability and Sources of Funding (Chapter 11); and Evidence of Success of the GK–12 Approach (Chapter 12). He is a co-author of the chapter Sustainability and Funding Resources. The 170+ page Guide containing 12 chapters was published in July 2013.

13. Received a **2011 Jacobs Excellence in Education Award** at NYU-Poly for “pioneering programs to promote K-12 STEM education and receiving national recognition through an Outstanding Project Award from the National Science Foundation.” The award carries a grant of \$10,000 to be expended at the discretion of the recipient.
14. Awarded the **2011 Outstanding Project Award for Efforts in Sustainability and Media** by the National Science Foundation at the GK-12 Fellows Project Annual Meeting, Washington, DC, March 13, 2011.
15. Invited to the **U.S. National Science and Engineering Expo**, Washington, DC, October 23–24, 2010. Our showcase “Mechatronics Mania,” was one of only 15 NSF-funded research and education projects selected by NSF to be featured at the event.
16. Invited to represent our NSF-funded Science and Mechatronics Aided Research for Teachers (SMART) project at the **2010 Teacher Research Experience Conference** in Washington, D.C. from October 22-24, 2010. Our project was one of only 55 Teacher Research Experience (TRE) programs invited on behalf of NOAA and its partners, as part of a coordinated effort to share best practices among institutions and programs that provide teacher research experiences for K-20 educators
17. Invited to speak to the new PIs of National Science Foundation’s GK–12 Fellows Program, March 2010, on “Sustaining GK-12 Projects.”
18. Received a **2008 Jacobs Excellence in Education Award** at NYU-Poly for “creating several nationally recognized programs to promote interest among elementary, junior high, and high school students in science, technology, engineering and mathematics (STEM), critical areas of study for students preparing to compete in an increasingly global economy.” The award carries a grant of \$10,000 to be expended at the discretion of the recipient.
19. Selected for a three-year term as a **Senior Faculty Fellow** of Polytechnic University’s **Othmer Institute** for Interdisciplinary Studies (Fall 2004–Summer 2007).
20. Presented an invited **Plenary Lecture** titled “Hands-on Mechatronics Education: A Brooklyn Poly Perspective,” at the 17<sup>th</sup> Florida Conference on the Recent Advances in Robotics held at the University of Central, Orlando, FL, May 2004.
21. Inducted as an eminent engineer in **Tau Beta Pi**, The Engineering Honor Society, upon invitation from student members of Polytechnic chapter, the NY Rho (November 2003).
22. Invited to represent our “Research Experience for Teachers Site in Mechatronics” at the **2004 NSF Design, Service, and Manufacturing Grantees and Research Conference**, January 2004, Dallas, TX and the **Research Experience for Teachers (RET) National Conference** titled Assessing, Determining, and Measuring the Impacts of the Research Experience (ADMIRE), November 2003, San Francisco, CA.
23. Received the **2003 Distinguished Teacher Award** at Polytechnic University. The award carries a grant of \$10,000 to be expended at the discretion of the recipient.
24. Received a **2002 Jacobs Innovation Grant** at Polytechnic University to develop “A Toolkit for Mechatronics Projects.” The grant provides \$10,000 to support our new undergraduate sequence in mechatronics.
25. Received a **2002 Jacobs Excellence in Education Award** at Polytechnic University for “demonstrated educational innovation and excellence in creating an internationally recognized web-



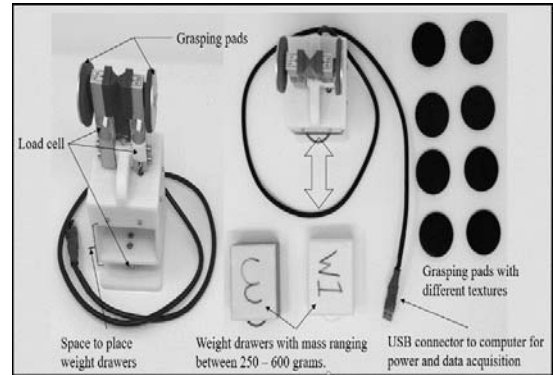
based control laboratory funded by a National Science Foundation grant.” The award carries a grant of \$10,000 to be expended at the discretion of the recipient.

26. Invited to participate in the **NSF Showcase** with “special focus” on engineering labs and distance education at the *American Society of Engineering Education Annual Conference*, June 2001, Albuquerque, NM. Our showcase title: “Mechatronics/process control remote laboratory.

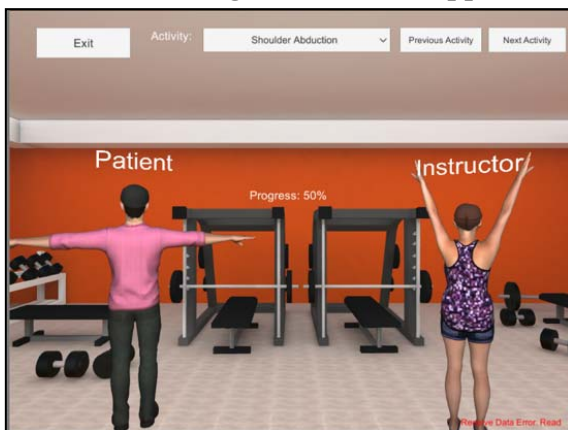
## 7. RESEARCH INTERESTS

Below I provide an overview of my research activities in three thrust areas.

**Convergence Research in Frontier Technologies:** I envision a future where robots readily and flexibly assimilate into the homes and workplaces to catalyze health and wellness of users of varied ages and backgrounds, including elderly and those with physical and cognitive disabilities. To realize this future, my research seeks to render multi-modal, intuitive, and natural immersive environments for human-robot interaction by exploiting the ubiquitous, low-cost communication and computing hardware, e.g., mobile devices. My research team exploits state-of-the-art features of mobile devices—multi-touch screens, embedded graphics, on-board sensors, 3-D animations, etc.—to provide highly visual, interactive, and immersive mixed-reality environments. As delineated below, in the Mechatronics, Controls, and Robotics Lab (MCRL), technologists, computer scientists, and physicians collaborate to engineer mechatronic and robotic devices for healthcare applications. First, to support hand rehabilitation for stroke survivors, we have developed a low-cost mechatronics grasp rehabilitator that can promote game-based telerehabilitation. Second, to control the uterine wall contraction in preterm labor, we have transformed a bench-top electronic uterine control device to render a miniature, disposable pulse generator with smartphone-based patient and physician control interfaces. Third, to support robot-assisted therapy with mobile “apps” for autistic children, we have created a highly expressive humanoid robot using a modular, open-source design, prototyped using low-cost 3D printers. Above mechatronics and robotics research is creating novel **Cyber Physical Systems** that have the potential to broaden the appeal of robotics to children and adults with minimal technical expertise, physical and cognitive disabilities, or situational impairments.



To accelerate the societal impact of our research, we have begun a transition towards exploring convergence research in frontier technologies, *viz.*, robotics, artificial intelligence (AI), augmented reality/virtual reality (AR/VR), and blockchain technologies. Following examples illustrate the potential of such a convergence research approach. First, we seek to examine the viability of using myoelectric signals—with Gaussian filtering and machine learning—to classify human hand gestures and allow a robot hand to mimic the gestures, with potential to disrupt the prosthetic hand market. Second, we are investigating a game-based, rehabilitation system, using an instrumented cup, wherein computer vision algorithms track the movement of the cup as a stroke patient uses her forearm to perform a complex goal-oriented and task-specific activity, namely drinking from the cup. Third, building on our game-based hand rehabilitation approach, we are enabling therapy, monitoring, compliance, and assessment for arm rehabilitation through “Wearable Inertial Sensors for Exergames (WISE).” Fourth, to automate the process of eye contact training and assessment for autistic children, we seek to develop smart glasses, with connectivity to a smartphone, to aid in automatic data acquisition and myriad analytics related to eye contact. Fifth, a smartphone-based AR application has been developed to facilitate highly natural and intuitive human-robot collaboration in performing pick-and-place operations on random, unknown objects in an unconstrained environment within a robot’s workspace, with potential for applications in construction environments riddled with obstacles. Sixth, we seek to examine the interaction between auditory perception and balance for those facing difficulty in



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balancing. To do so, we are prototyping a wearable device, i.e., a hat instrumented with inertial sensors, to measure head orientation with the aid of signal filtering and machine learning algorithms. Seventh, in recent research we have begun to explore implications of blockchain technology in rendering intuitive human supervision of decentralized multi-robot system with dark-room exchange, distributed ledgers, and network mapping. The aforementioned convergence research will generate knowledge and learning in: designing wearables, interfacing mechatronic and robotic devices using gaming and machine learning, application of visually assistive therapy, development of comprehensive rehabilitation metrics, evaluation of rehabilitation performance through clinical studies, and cloud-based services for asynchronous telerehabilitation, among others.

**STEM Education:** Today's youth exhibit a lack of interest in pursuing STEM careers, despite the fact that they live in and benefit from a highly technological world, one that includes PlayStation, iPhones, and instant messaging. My STEM research, education, and mentoring programs are taking advantage of robotics as a tool to transition students' extra-curricular robotic experiences to an in-class setting for science and math learning. As delineated below, through a series of studies, I am investigating: *Whether the motivational power and new affordances of robotics can be effectively harnessed to positively influence the learning of science and math in K-12 environment?*

First, I have analyzed the effectiveness of several LEGO Mindstorms-based science and math lessons (elementary, middle, and high school grades) using pre- and post-lesson assessment surveys and statistical hypothesis tests. Second, I have led a study that utilized low-intensity resources (e.g., a short training workshop, user-guides, and building and programming instructions), self-efficacy and engineering design performance instruments, and video analysis to assess the skills gained by K-12 mentors and teachers with varied levels of education, teaching, and prior robotics expertise. Third, I have led the mindful design of robotics-based activities, centered on **Bloom's taxonomy**, to investigate the effectiveness of connecting cognitive domains of Bloom's taxonomy and robotics to promote learning in K-12 environment. Fourth, in a multi-year project, I led the integration of modern sensing, instrumentation, and monitoring technologies in the curriculum of science labs at five NYC high schools. The most convincing evidence of the project's positive effect on students is that when data from all classes is averaged, a higher percentage of project students (>60%) passed the Regents Living Environment exam than did non-project students (<40%) from the same schools. Fifth, in an on-going effort, I have built on my decade-long experience in designing, conducting, and evaluating mechatronics-based teacher professional development (**PD**) programs, to create a new program that enhances teachers' STEM understanding while allowing them to experience the thrills of technology entrepreneurship. These efforts are serving as catalysts to induce a cultural change that can transform students from being mere consumers of technology to become creators of novel technological products.



Under an on-going NSF-supported research project, I am lowering the barriers in STEM disciplines for students through PD of middle school science and math teachers by using robotics as the curriculum focus. This effort is overcoming two challenges to the integration of robotics in science and math learning by performing *design-based research*. The first challenge is lack of curricula to ensure that the science and math content inherent in robotics and related engineering design practices are learned at a sufficiently deep level to justify classroom adoption of robotics. This challenge offers us an opportunity to develop and refine curricula that promote project-based, hands-on, instruction to ensure that students learn, understand, and apply the underlying science and math content while doing age-appropriate robotics activities. The second challenge is teachers' lack of preparation and training to use robotics in science and math teaching. Most teachers do not have effective models or knowledge to capitalize on robotics for elucidating science and math concepts. We are building on the construct of

technological, pedagogical, and content knowledge (**TPACK**) to create and conduct a PD program that allows teachers to use their students' interest in robotics to engage them to learn the required science and math content. We hypothesize that our PD model, which applies what the field knows and what we know empirically from our prior work, will (1) build teachers' capacity to effectively utilize robotics to teach middle school science and math and ultimately (2) positively impact student learning, beliefs, attitudes, perceptions, and motivation in STEM. I have formed an interdisciplinary team of experts in robotics, engineering, education, curriculum design, and assessment—with experience in K-12 education, training, and outreach—to make robotics central to and sustainable in middle school science and math classrooms.

**Control System Technology.** In my early career, I made fundamental advances in the theoretical, applied, and experimental control. My *theoretical control* research addressed applications where controllers must robustly stabilize systems in the presence of uncertainties, disturbances, time delays, and actuator saturation. I developed stability and robustness analysis tools for linear and nonlinear systems and formulated a fixed-architecture multi-objective control design framework to treat diverse uncertainty characterizations and performance specifications that appeal to different applications. My *applied control* research advanced control technology for spacecraft formation flying. Implementation of distributed spacecraft formation, vigorously pursued by the U.S. Air Force and NASA in 2000s, necessitated control of relative distances and phases between the spacecraft in a formation. I studied pulse-based linear control, adaptive and robust nonlinear control, coupled orbit and attitude control, multi-agent cooperative control, and the effects of Earth's oblateness on spacecraft dynamics, to address real-world issues arising in spacecraft formation flying. My *experimental control* research allowed remote control of lab testbeds via the Internet by using embedded server microcontrollers, which can enable remotely accessible sensor networks, telemedicine devices, etc. Moreover, I developed an experimental technique for structural integrity assessment that uses chaotic excitation, statistical analysis, and wave fractal dimension to detect and characterize cracks in beams.

