

## Mark D. Bedillion

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CONTACT INFORMATION	Scaife Hall 410 Department of Mechanical Engineering Carnegie Mellon University Pittsburgh, PA 15213 USA	<i>Voice:</i> (412) 268-8871 <i>Cell:</i> (724) 713-4132 <i>E-mail:</i> mbedillion@cmu.edu <a href="http://www.andrew.cmu.edu/user/capn/">http://www.andrew.cmu.edu/user/capn/</a>
RESEARCH INTERESTS	distributed manipulation, control for data storage applications, control applications in robotics, STEM education	
EDUCATION	<b>Carnegie Mellon University</b> , Pittsburgh, Pennsylvania USA Ph.D., Mechanical Engineering, December 2005 <ul style="list-style-type: none"><li>• Dissertation Topic: “Distributed Manipulation with Rolling Contact”</li><li>• Advisor: William C. Messner</li></ul> M.S., Mechanical Engineering, May 2001 B.S., Mechanical Engineering, May 1998	
HONORS AND AWARDS	Carnegie Mellon University: graduated with college and university honors, Phi Kappa Phi, Tau Beta Pi Best Presentation Award, Bennett Technical Conference, 2001 Best Teaching Assistant Award in Mechanical Engineering, Fall 2001 Best Teaching Assistant Award in Mechanical Engineering, Fall 2002 Best Presentation Award, ASEE Rocky Mountain Section Conference, 2013 Strumminger Fellowship, 2018.	
PROFESSIONAL SOCIETIES	Senior Member of IEEE Member of ASME Member of ASEE	
ACADEMIC EXPERIENCE	<b>Carnegie Mellon University</b> , Pittsburgh, Pennsylvania USA <i>Associate Teaching Professor</i>	<b>August 2016 - Present</b> <ul style="list-style-type: none"><li>• 24-354 Gadgetry: Sensors, Actuators, and Processors, F 2016, S 2017, S 2018</li><li>• 24-451 Feedback Control Systems, F 2016</li><li>• 18/24-771 Linear Systems, F 2016</li><li>• 24-773 Multivariable Linear Control, S 2017, S 2018</li><li>• 24-671 Electromechanical Systems Design, F 2017, S 2018</li><li>• 24-774 Advanced Control Systems Integration, F 2017</li></ul>
	<b>South Dakota School of Mines and Technology</b> , Rapid City, South Dakota USA <i>Associate Professor</i>	<b>January, 2011 - August, 2016</b> <ul style="list-style-type: none"><li>• ME-110 Introduction to Mechanical Engineering, F 2014</li><li>• ME-221 Dynamics of Mechanisms, S 2011-F 2013, F 2014, F 2015</li><li>• ME/EE/CENG-351 Mechatronics, S 2015</li><li>• ME-352 Introduction to Dynamic Systems, F 2011, Su 2012, S 2013, S 2014, S 2015</li><li>• ME-457/557 Intermediate Dynamics, F 2013, F 2015</li></ul>

- ME/EE-453/553 Control Systems, S 2014

**Carnegie Mellon University**, Pittsburgh, Pennsylvania USA

*Teaching Assistant*

**August 2001 - December, 2002**

- 24-451 Feedback Control Systems, Fall 2001, Fall 2002.
- 24-352 Dynamic Systems and Control, Spring 2002

*Research Assistant*

**August, 1999 - August, 2001**

STUDENTS ADVISED

- Xuan Chen, M.S., expected 2019
- Xinjia Yu, M.S., expected 2019
- Waleign Nikshi, Ph.D., expected 2018
- Aaron Lalley, Ph.D., 2017
- Erlend Framstad, M.S., 2015
- Jesse Nelson, M.S., 2014
- Deepak Parajuli, M.S., 2014
- Subhasish Malik, M.S., 2012
- Craig Stensland, M.S., 2012
- Yogesh Darekar, M.S., 2011

PUBLICATIONS

- Muci, **Bedillion**, Degen, Ellingsen, and Huang, 2017, *Incorporating Basic Systems Thinking and Systems Engineering Concepts in a Mechanical Engineering Sophomore Design Course*, ASEE Annual Conference and Exposition
- Degen, Huang, Muci, Ellingsen, and **Bedillion**, 2017, *Leveraging a Newly Developed Sophomore Design Course to Increase Students' Career Awareness*, ASEE Annual Conference and Exposition
- Nikshi, Hoover, and **Bedillion**, 2017, *Nonlinear Control Synthesis for Parking Control of Mixed Conventional/Braking Actuation Mobile Robots*, American Control Conference
- Lalley and **Bedillion**, 2016, *Novel Direct Model for Machining Regenerative Chatter*, Proceedings: International Mechanical Engineering Congress and Exposition
- Muci-Kuchler, **Bedillion**, Degen, Ellingsen, and Huang, 2016, *Incorporating Basic Systems Thinking and Systems Engineering Concepts in a Sophomore-Level Product Design and Development Course*, Proceedings: International Mechanical Engineering Congress and Exposition
- Simmons II, Nikshi, **Bedillion**, and Hoover, 2016, *Mechatronic Design of a Mixed Conventional / Braking Actuation Mobile Robot*, Proceedings: International Mechanical Engineering Congress and Exposition
- Nikshi, **Bedillion**, and Hoover, 2016, *Parking Control of Mixed Conventional / Braking Actuation Mobile Robots Using Fuzzy Logic Control*, Proceedings: International Mechanical Engineering Congress and Exposition
- Framstad and **Bedillion**, 2015, *Control for Robots with Braking Actuators in a Uniform Force Field*, Proceedings: International Mechanical Engineering Congress and Exposition
- Huang, Muci, **Bedillion**, Ellingsen, and Degen, 2015, *Systems Thinking Skills of Undergraduate Engineering Students*, Proceedings: IEEE Frontiers in Education Conference
- **Bedillion**, Mohammed Nizar, and Hoover, 2015, *Virtual Laboratories Using Simulink: A Pilot Study*, ASEE Annual Conference and Exposition
- Huang, Degen, Ellingsen, **Bedillion**, and Muci-Kuchler, 2015, *Investigating the Impact of an Outreach Activity on High School Students' Attitude towards STEM Disciplines*, ASEE Annual Conference and Exposition
- Lalley, **Bedillion**, Langerman, and Korde, 2015, *Early Incorporation of Design for Manufacturing in the Engineering Curriculum*, ASEE Annual Conference and Exposition
- Ramakrishnan, **Bedillion**, and Chu, 2014, *Performance-Optimized Design of Electromagnetic Micro-Actuator for Probe Recording Storage Device*, Microsystem Technologies, Vol. 20, #6, pp.

- Parajuli, **Bedillion**, and Hoover, 2014, *Actuator Array Manipulation Using Low Resolution Local Sensing*, Proceedings: International Mechanical Engineering Congress and Exposition
- McGough, **Bedillion**, and Hoover, 2014, *Replacing Servos with Braking in an Omnidirectional Vehicle*, Proceedings: International Mechanical Engineering Congress and Exposition
- **Bedillion**, Hoover, and McGough, 2014, *A Distributed Manipulation Concept Using Selective Braking*, American Control Conference, pp. 3322-3328
- **Bedillion**, Raisanen, and Mohammed Nizar, 2014, *Improving Transitions Between Sophomore Dynamics and Junior Dynamic Systems Courses*, ASEE Annual Conference and Exposition
- Ellingsen, Degen, **Bedillion**, and Muci-Kuchler, 2014, *Effective Strategies for Generating Awareness and Interest in Science and Engineering among Underrepresented Youth*, ASEE Annual Conference and Exposition
- **Bedillion**, 2013, *Actuator Array Dynamics Incorporating Actuator Inertia*, Proceedings: International Mechanical Engineering Congress and Exposition
- **Bedillion**, Parajuli, and Hoover, 2013, *Distributed Sensing for Actuator Arrays*, Proceedings: International Mechanical Engineering Congress and Exposition
- **Bedillion** and Raisenan, 2013, *SolidWorks Examples for Dynamics Instruction*, Proceedings: ASEE Rocky Mountain Conference
- **Bedillion**, 2013, *Lagrangian Projects in Sophomore Dynamics*, Proceedings: ASEE Rocky Mountain Conference
- **Bedillion** and Messner, 2013, *Trajectory Tracking Control for Actuator Arrays*, IEEE Transactions on Control Systems Technology, 21(6), pp. 2341-2349
- Stensland and **Bedillion**, 2012, *Sequential vs. Parallel Synthesis for Dual Stage Hard Disk Drives*, Proceedings: International Mechanical Engineering Congress and Exposition
- Malik and **Bedillion**, 2012, *Event-Based Temperature Control for Machining Using MTConnect*, Proceedings: International Mechanical Engineering Congress and Exposition
- Brech, St. Amand, Hoover, McGough, and **Bedillion**, 2012, *Design & Development of a Vector Thrusting Quadrotor for Minimally Induced Pitch & Roll Motions*, Proceedings: International Mechanical Engineering Congress and Exposition
- Huang, Lee, Ramakrishnan, **Bedillion**, and Chu, 2010, *Nano-positioning of an Electromagnetic Scanner with a MEMS Capacitive Sensor*, Mechatronics, Vol. 20, #1, pp. 27-34
- Forrester, Ahner, **Bedillion**, et al., 2009, *Charge-based Scanning Probe Readback of Nanometer-scale Ferroelectric Domain Patterns at Megahertz Rates*, Nanotechnology, Vol. 20, #22
- Ramakrishnan and **Bedillion**, 2009, *A Novel Study of Head Motion Hysteresis Issues in Contact Probe Recording Systems*, Microsystem Technologies, Vol. 15, #4, pp. 595-606
- **Bedillion** and Messner, 2009, *Control for Actuator Arrays*, International Journal of Robotics Research, Vol. 28, #7, pp. 868-882
- Huang, Lee, Ramakrishnan, **Bedillion**, and Chu, 2008, *Nano-Positioning of an Electromagnetic Scanner with a MEMS Capacitive Sensor*, IFAC World Congress
- Huang, Gokemeijer, **Bedillion**, and Chu, 2008, *Head-Disk Spacing Control for an Advanced Rotary Tester*, American Control Conference, pp. 2999-3004
- Messner, **Bedillion**, Xia, and Karns, 2007, *Lead and Lag Compensators with Complex Poles and Zeros: Design Formulas for Modeling and Loop Shaping*, IEEE Control Systems Magazine, Vol. 27, pp. 44-54
- Ramakrishnan, Johns, Zhao, Kiely, **Bedillion**, and Chu, 2007, *Sliding Contact Micro-Bearing for Nano-Precision Sensing and Positioning*, Transducers, pp. 1689-1692
- **Bedillion** and Messner, 2007, *Distributed Manipulation with an Actuator Array and Vision Feedback*, American Control Conference, pp. 1982-1987
- **Bedillion** and Messner, 2006, *Trajectory Tracking for Actuator Arrays*, American Control Conference
- Crawford, van de Veerdonk, **Bedillion**, Koelmans, Langzettal, O'Connor, and Novotnak, 2006, *Seven-axis Tester with Servo-controlled Fly-height for Magnetic Recording Metrology*, ASPE Proceedings
- **Bedillion**, Karaman, and Chu, 2005, *Spinstand Control Characterization of an Electromagnetic*

*Slider Microactuator*, American Control Conference

- Karaman, Lu, and **Bedillion**, 2004, *Comparison of Suspension-Based and Slider-Based Microactuators for Track Following Performance*, 8th International Workshop on Advanced Motion Control, pp. 347-351
- **Bedillion** and Messner, 2004, *Distributed Manipulation with Rolling Contact*, Algorithmic Foundations of Robotics V, pp. 453-468
- **Bedillion** and Messner, 2003, *Distributed Manipulation with Stick-Slip Contact*, IEEE International Conference on Intelligent Robots and Systems
- **Bedillion** and Messner, 2003, *The Multivariable Circle Criterion for Switched Continuous Systems*, IEEE Conference on Decision and Control
- **Bedillion**, Messner, and Choset, 2001, *Rolling Contact Dynamics and Optimal Feedforward Control for the Modular Distributed Manipulator System*, Proceedings: International Mechanical Engineering Congress and Exposition
- **Bedillion**, Messner, and Choset, 2001, *Limitations Imposed by Single DOF Actuators on Discrete Actuator Arrays*, Proceedings: IEEE International Conference on Intelligent Robots and Systems
- Rubin and **Bedillion**, 1998, *A Comprehensive Approach to Power Plant Toxic Release Inventories*, Paper No. 98MA8.01, Proceedings of AWMA 91st Annual Conference, Air & Waste Management Association, Pittsburgh, PA

#### PATENTS

- US 8,134,796 (2012-03-13) **Bedillion**, *Embedded track information for patterned media*
- US 7,983,138 (2011-07-19) **Bedillion**, Chu, Ramakrishnan, Kiely, and De Gersem, *Surface spacing using rigid spacers*
- US 7,965,459 (2011-06-21) Ramakrishnan, Lee, and **Bedillion**, *Wavelets-based detection of proximity between a sensor and an object*
- US 7,948,337 (2011-05-24) Chu, Ramakrishnan, and **Bedillion**, *Simultaneous rotational control using offset linear actuators*
- US 7,924,692 (2011-04-12) Liem, **Bedillion**, Chu, Gomez, and Lutwyche, *Actuator Assembly Providing Two-Dimensional Movement of a Moveable Element in a Data Storage Device*
- US 7,903,533 (2011-03-08) **Bedillion**, Roelofs, Johns, Zhao, and Skalko, *Probe Head with Narrow Read Element*
- US 7,903,532 (2011-03-08) Chu, **Bedillion**, Johns, and Lutwyche, *Elevated Electrodes for Probe Position Sensing*
- US 7,889,627 (2011-02-15) Ramakrishnan, Chu, and **Bedillion**, *Preload Modulation to Reduce Head Motion Hysteresis*
- US 7,885,025 (2011-02-08) Eppler, Ozgunes, Feng, Gomez, **Bedillion**, and Wrazien, *Generating PES Using Readback Signal Distortion*
- US 7,835,094 (2010-11-16) **Bedillion**, *Embedded Track Information for Patterned Media*
- US 7,626,894 (2009-12-01) **Bedillion**, Chu, et al., *Heat Assisted Magnetic Recording Light Delivery with Fixed Laser and Rotating Mirror*
- US 7,576,942 (2009-08-18) Karns, **Bedillion**, Ling, and Erden, *Servo Sector Format with Large Lithographic Tolerances*
- US 7,570,451 (2009-08-04) **Bedillion**, Chu, Huang, and Gomez, *Servo Architecture for High Areal Density Data Storage*
- US 7,447,140 (2008-11-04) Lutwyche, Johns, Forrester, **Bedillion**, et al., *Ferroelectric Probe Storage Apparatus*
- US 7,265,937 (2006-06-09) Erden, **Bedillion**, Kurtas, Yang, and Karns, *Positioning of a Head Array Over a Data Storage Medium*

#### INVITED TALKS

“Sequential vs. Parallel Synthesis for Dual Stage Hard Disk Drives,” *IEEE Black Hills Subsection Technical Session*, November 2012

#### RESEARCH GRANTS

- PI: “A Portable Laboratory for Dynamic Systems and Controls”, CMU Struminger Fellowship (\$20000), 1/2018 - 12/2018

- Co-PI: “Promoting System-Level Thinking in Undergraduate Engineering Courses”, US Office of Naval Research (\$303224), 10/2015 - 10/2017
- PI: “Virtual Dynamic Systems Laboratories Using V-Realm”, SD-BOR Mobile Computing Instructional Design and Development (\$30,000), 8/2013 - 6/2015
- PI: “Basic Small-Scale Submarine for Educational and Outreach Activities”, NASA SD EP-SCoR (\$20,000), 8/2013 - 4/2016
- Co-PI: “Submersible Vehicles and Submarines Teaching Module: Development and Implementation”, South Dakota EPSCoR (\$5,000), 6/2013 - 12/2013
- PI: “Mobile Computing for Dynamics Instruction”, SD-BOR Mobile Computing Instructional Design and Development (\$26,691), 8/2012 - 6/2015
- Co-PI: “Increasing Autonomous Capability Through Collaborative UAV/UGV Swarms”, SD-BOR Competitive Research Seed Grant Program (\$85,310), 8/2012 - 8-2013
- PI: “Advanced Materials and Processes for Future Combat Systems”, USDOD - US Army Research Lab (\$77,250), 1/2011 - 8/2014

CMU  
DEPARTMENTAL  
SERVICE

- Graduate Education Committee 8/2016 - present
- Curriculum Review Committee 8/2017 - present

PROFESSIONAL  
SERVICE

- Reviewer for various journals and conferences (e.g. IEEE Magnetics, CDC, ACC, TCST, Sensors, FIE; ASME IMECE, DSCC, Dynamic Systems, Measurement and Control; ASEE Annual Conference; IFAC Automatica, World Congress)
- Member of ASME Dynamics and Control of Systems and Structures technical committee
- Panelist for NSF Sensors, Dynamics, and Control 2015

OUTREACH

- UNITE - Submarines and Submersibles Module Co-Developer, Co-Instructor - 2013, 2014
- UTTC Nature Camp - Submarines and Submersibles Module Co-Developer, Co-Instructor - 2013

PROFESSIONAL  
EXPERIENCE

**Seagate Technology**, Longmont, Colorado USA

*Senior Staff Engineer*

**February, 2009 - December, 2010**

Work focused on underpinning the servo/mechanical roadmap for desktop and nearline drive products and advanced drive integration of new recording technologies. Theoretically and experimentally evaluated new servo technologies (dual-stage microactuation, mechanical disturbance improvements) and planned product intercepts. Provided servo support for various next generation recording system technologies, including development of track mis-registration budgets, algorithm development, and code implementation.

**Seagate Technology**, Pittsburgh, Pennsylvania USA

*Research Engineering Manager*

**October, 2007 - February, 2009**

Responsible for defining and implementing servo/mechanical research projects to improve the performance of future generation data storage products. Managed four PhD's on projects in hysteresis compensation, MEMS microactuator design, servo performance projection, feedforward sensor design, and contact detection. Also contributed as an individual researcher in the areas of bit patterned media modeling and heat assisted magnetic recording servo patterns.

*Research Staff Member*

**June, 2003 - October, 2007**

Responsible for servo control algorithm design and implementation in the Servo Dynamics group. Primary responsibility was servo/mechanical architecture design for a next-generation probe storage device. Worked on mechanics design, sensor design, feedback architecture, and control algorithm development for a project targeting much higher density recording than standard disk drives. Design of DIDO servo systems using classical and modern techniques. Was also involved in many other projects requiring control expertise, including instrumentation development.

- COMPUTER SKILLS
- Software Packages: ProEngineer, SolidWorks, Matlab/Simulink, Maple, Ansys, Abaqus, Minitab, LabWindows
  - Languages: C, C++, Matlab