

Verica Radisavljevic-Gajic CV

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SCOPUS: <https://www.scopus.com/authid/detail.uri?authorId=12799309800>

DEGREES:

Dipl. Ing. Mechanical Engineering (five year program), University of Belgrade, May 1990.

Major in Automatic Control Systems. Diploma Thesis: *Stability of Dynamical Systems via Root Locus and Lyapunov Techniques*. Diploma Thesis Advisor: Prof. D. Debeljkovic.

M. S. Mechanical and Aerospace Engineering, Rutgers University, October 1996.

MS Thesis: *Pointwise Optimal Control of Dynamic Systems Described by Differential-Algebraic Equations*, M. S. Thesis Advisor: Prof. Haim Baruh. **GPA 4.00/4.00.**

Ph. D. Mechanical and Aerospace Engineering, Rutgers University, October 2001.

Doctoral Dissertation: *Modeling and Control of Complex Mechanical Systems*.

Dissertation Advisor: Prof. Haim Baruh, **GPA 4.00/4.00.**

Graduate Course Work

Analytical Dynamics, Advanced Topics in Analytical Dynamics, Fluid Dynamics, Introduction to Mechanics of Materials, Advanced Mechanics of Materials, Theory of Elasticity, Computational Methods III: Finite Element Methods in Solid Mechanics, Applied Mathematics I, Applied Mathematics II, Linear Algebra, Robotics and Control, Optimal Design in Mechanical Engineering, Advanced Design of Mechanisms, Mechanical Vibrations Random Vibrations, Independent Studies in Control Systems.

Current Research Interests

- Control, dynamics, and modeling of complex systems composed of subsystems displaying multiple time scales with applications to clean energy proton exchange membrane fuel cells, bioengineering systems (HIV virus dynamics and control, protein cell signaling and calcium dynamics, eye movement dynamics, modeling of the arterial system) and autonomous unmanned vehicles (AUV) including drones. Observers. Approximate dynamic programming and reinforcement learning.
- Control, dynamics, and modeling of distributed parameter dynamic systems (particularly heat and Euler-Bernoulli beam equations).
- Cyber physical control systems (CPS), Internet of Things (IoT), and improvement of machine learning (ML) algorithms using control system techniques.
- Educational methods for teaching advanced and modern topics to undergraduate students.

Previous Research Experience

- Dynamics, modeling and control in systems biology (protein cell signaling and modeling of calcium dynamics, metabolism modeling, heart and arterial dynamics).
- Mechatronics (electronic control of optical fiber amplifiers), design of electrical-mechanical systems, and computer simulation with numerical methods.
- Dynamic systems described by differential-algebraic equations.

Software Tools: MATLAB, SIMULINK, SimBiology, LabVIEW, Python, MathCad, Fortran 90, Microsoft Office, Corel Draw, IDEAS and INVENTER (CAD software), ANSYS, AutoCAD, MS-DOS, UNIX, Programming for PLC, SOLIDWORKS.

E-Learning Software/Platforms: Blackboard, Sakai, Moodle, MediaCite, Webex, Zoom.

PROFESSIONAL EXPERIENCE:

- Assistant Professor, Ajman University, UAE*, Department of Mechanical Engineering, Aug. 2022 – present. Courses taught: *Introduction to Engineering, Design of Machine Elements, Computational Methods, Renewable Energy Systems, Engineering Mechanics-Dynamics, Thermodynamics, Finite Elements Methods with Applications, Engineering Drawing & Mechanical Workshop, Heat Transfer, Design of Machine Elements, Control Systems.*
- Assistant Professor, Prince Mohammad bin Fahd University, KSA*, Department of Mechanical Engineering, Aug. 2021 – July 2022. Courses taught: Teaching female engineering students. *Statics, Computational Methods, Mechanical Engineering Design II, Senior Project Design.*
- Clare Boothe Luce Assistant Professor, Villanova University*, Department of Mechanical Engineering, Aug. 2012-May 2019. Courses taught: *Statics, Dynamics Systems I, Honor Dynamic Systems I, Dynamics Systems Lab, ME Laboratory I, II, and III* (undergraduate courses), and *Advanced Dynamics, Orbital dynamics* (graduate courses, taught on-line).
- Visiting Assistant Professor (on leave from CSULA), American University of Sharjah, UAE*, Department of Mechanical Engineering, Sept. 2010 - June 2012, on leave from CSULA. Courses taught: *Control Systems, Advanced Engineering Mathematics, Nonlinear and Intelligent Control Systems* (graduate courses) and worked on the development of an undergraduate control systems laboratory.
- Assistant Professor California State University Los Angeles (CSULA)* Department of Mechanical Engineering, Fall 2009 - June 2012. Courses taught: *Introduction to Mechanical Design, Control of Mechanical Systems* (undergraduate courses) and *Dynamic Systems Analysis, Advanced Particle Mechanics, Optimal Control of Mechanical Systems* (graduate courses)
- Postdoctoral Fellow/Researcher, Rutgers University, Department of Mathematics*, Oct. 2006 – March 2009. Research in *systems biology*, protein cell signaling and modeling of cell calcium dynamics, supervised by Professor E. Sontag and Dr. R. Dinerstein from Sanofi-Aventis, Bridgewater, NJ. Research in *systems biology* on metabolism modeling, supervised by Prof. E.Sontag.
- Full-Time Visiting Assistant Professor, Lafayette College, Department of Mechanical Engineering*, Easton, Pennsylvania, Aug. 2004 - June 2006. Courses taught: *Dynamic Systems, Controls, and Mechatronics Laboratory* (3 credits), *Manufacturing and Design, Engineering Design II, Dynamics.*
- Visiting Professor: Rutgers University, Department of Electrical and Computer Engineering*, Sept. 2002 - June 2004 and Jan. 2007-June 2009. Courses taught: *Introduction to Automatic Control, Control System Design*, and *Control Theory I* and *Control Theory II* (graduate courses). Member of the Ph. D. Qualifying Committee in the control systems area).
- Adjunct Professor: Rutgers University, Department of Mechanical and Aerospace Engineering* Spring 2002 - Spring 2004. Courses taught: *CAD, Dynamics, and Honor Dynamics.*
- Teaching Assistant, Department of Mechanical and Aerospace Engineering*, Rutgers University, 1994-2001. Courses: *Vibration and Control, Mechanical Control Systems Dynamics, Orbital Mechanics, Computer Aided Drafting, Introduction to Computers for Engineers.*
- Member of Technical Staff, Gosa Research Institute*, Belgrade, Yugoslavia, 1990-1994 (supervisor Dr. J. Boskovic, presently with Scientific Systems Company, Woburn, MA).
Development of control units for industrial robots; Automation of fermentation plants (including plant and process sterilization); AutoCAD.

PUBLICATIONS:

A. Book/Research Monograph

- 1) V. Radisavljevic-Gajic, M. Milanovic, P. Rose, *Multi-Stage and Multi-Time Feedback Control of Linear Systems with Applications to Fuel Cells*, 214 pages, Springer, Series Research Monographs in Mechanical Engineering, Feb. 2019.
- 2) V. Radisavljevic-Gajic, *Full- and Reduced-Order Observer Based Optimal Control of Linear Systems*, approximately 200 pages, in preparation.

B. Journal Papers Published:

- [1] V. Radisavljevic-Gajic, "Design of Reduced-Order Observer Based Steady State Optimal Linear-Quadratic Feedback Controllers," *Journal of the Franklin Institute*, vol. 361, 107015, (14 pages), June **2024**.
- [2] V. Radisavljevic-Gajic, D. Karagiannis, and Z. Gajic, "Linear, Nonlinear, and Distributed Parameter Observers for (Renewable) Energy Processes and Systems – An Overview," *Energies*, vol. 17, 2700, doi.org/10.3390/en17112700, (25 pages), June **2024**.
- [3] D. Karagiannis and V. Radisavljevic-Gajic, "Control of Resonant Disturbances on an Euler Bernoulli Beam Using a Robust PDE Boundary Control Technique," *ASME Letters in Dynamic Systems and Control*, vol. 4, pp. 021003-1 – 021003-4, Apr. **2024**.
- [4] V. Radisavljevic-Gajic, D. Karagiannis, and Z. Gajic, "The Modeling and Control of (Renewable) Energy Systems by Partial Differential Equations – An Overview," *Energies*, vol. 16, 8042, (23 pages), <https://doi.org/10.3390/en16248042>, Dec. **2023**.
- [5] V. Radisavljevic-Gajic, "Control of Autonomous Vehicles via Multistage Feedback Design," *Transactions of ASME Journal of Dynamic Systems, Measurement, and Control*, vol. 45, 041004-1-041004-12, Apr. **2023**.
- [6] V. Radisavljevic-Gajic, "Linear-Quadratic (LQ) Optimal Steady State Controllers for Engineering Students and Practicing Engineers," *International Journal of Mechanical Engineering Education*, Vol. 49, 316-358, **2021**.
- [7] M. Milanovic and V. Radisavljevic-Gajic, "Multi-Time Scale-Based Partial Optimal Control of a Proton-Exchange Membrane Fuel Cell," invited paper, *Energies* **2020**, 13, 166; 24 pages, doi:10.3390/en13010166.
- [8] D. Karagiannis and V. Radisavljevic-Gajic, "A Backstepping Boundary Observer for a Simple Supported Beam," *IEEE Transactions to Automatic Control*, Vol. 64, 3809-3816, Oct. **2019**.
- [9] D. Karagiannis and V. Radisavljevic-Gajic, "Exponential Stability for a Class of Boundary Conditions on an Euler-Bernoulli Beam Subject to Disturbances via Boundary Control" *Journal of Sound and Vibration*, Vol.446, 387-411, **2019**.
- [10] D. Karagiannis and V. Radisavljevic-Gajic, "Sliding Mode Boundary Control for an Euler-Bernoulli Beam Subject to Disturbances," *IEEE Transactions to Automatic Control*, Vol. 63, 3442-3448, Oct. **2018**.
- [11] V. Radisavljevic-Gajic, "Dynamics of Eye Movement under Time Varying Stimuli," *Journal of Eye Movement Research*, Vol.5, 1-7, June **2018**.
- [12] V. Radisavljevic-Gajic and M. Milanovic, "Loss of Optimal Performance of the Finite-Horizon Continuous-Time Linear-Quadratic Controller driven by a Reduced-Order Observer," *Transactions of ASME Journal of Dynamic Systems, Measurement, and Control*, Vol. 140, pp. 061014-1-061014-8, June **2018**.
- [13] D. Karagiannis and V. Radisavljevic-Gajic, "Sliding Mode Boundary Control for a Pinned-Pinned Beam with Disturbances," *Journal of Vibration and Control*, Vol. 24, 1109-1122, June **2018**.
- [14] V. Radisavljevic-Gajic, S. Park, and D. Chasaki, "Vulnerability of Cyber-Physical Linear Control Systems to Sophisticated Attacks," *IEEE Internet of Things*, Vol.5, 1023-1032, April **2018**.
- [15] V. Radisavljevic-Gajic, M. Milanovic, and G. Clayton, "Three-Stage Feedback Controller Design with Applications to Three Time-Scale Control Systems," *ASME Journal of Dynamic Systems Measurements and Control*, Vol. 139, pp.104502-1-104502-10, Oct. **2017**.
- [16] V. Radisavljevic-Gajic, "Simplified Derivations of Time-Weighted Quadratic Functionals Used in Optimal Control Applications," *Proceedings of the Institution of Mechanical Engineers Part I: Journal of Systems and Control Engineering*, Vol. 229, 983-988, 2015.
- [17] V. Radisavljevic-Gajic, "Full-Order and Reduced-Order Observer Implementations in MATLAB/SIMULINK," *IEEE Control Systems Magazine*, 91-101, 2015.
- [18] V. Radisavljevic-Gajic, "Two-Stage Feedback Design for a Class of Linear Discrete-Time Systems with Slow and Fast Variables," *ASME Journal of Dynamic Systems Measurements and Control*. Vol. 137, pp. 084502-2-084502-6, Aug. 2015.

- [19] V. Radisavljevic-Gajic, "A Simplified Two-Stage Design of Linear Discrete-Time Feedback Controllers," *ASME Journal of Dynamics, Measurements, and Control*, Vol. 137, pp. 014506-1-014506-7, Jan. 2015.
- [20] V. Radisavljevic-Gajic and P. Rose, "A New Two-Stage Design of Feedback Controllers for a Hydrogen Gas Reformer," *International Journal of Hydrogen Energy*, Vol. 39, 11738-11748, 2014.
- [21] V. Radisavljevic-Gajic, "Nonlinear Integral Control of Photon Power Transients in Optical Networks with Erbium-Doped Fiber Amplifiers," *IET Circuits, Devices & Systems*, Vol. 8, 412-420, Sept. 2014.
- [22] V. Radisavljevic, "Optimal Parallel Controllers and Filters for a Class of Second-Order Linear Dynamic Systems," *Journal of Control and Systems Engineering*, Vol. 1, 37-49, Sept. 2013.
- [23] V. Radisavljevic, and S. Koskie, "Suboptimal Strategy for Finite-Time Linear-Quadratic Optimal Control Problem," *IET Control Theory and Applications*, Vol. 6, 1516-1521, 2012.
- [24] V. Radisavljevic, "Improved Potter-Anderson-Moore Method for Solving the Riccati Differential Equation of Optimal Control and Filtering," *Applied Mathematics and Computation*, Vol. 218, 4641-4646, 2011.
- [25] V. Radisavljevic, "On Controllability and System Constraints of the Linear Models of Proton Exchange Membrane and Solid Oxide Fuel Cells," *Journal of Power Sources*, Vol. 196, 8549-8552, 2011.
- [26] M-B. Cheng, V. Radisavljevic, and W-C. Su, "Sliding Mode Boundary Control of a Parabolic PDE System with Parameter Variations and Boundary Uncertainties," *Automatica*, Vol. 47, 381-387, 2011.
- [27] V. Radisavljevic-Gajic, "Optimal Control of HIV-virus Nonlinear Dynamics", *Annals on Biomedical Engineering*, Vol. 37, 1251-1261, 2009.
- [28] M-B. Cheng, V. Radisavljevic, C-C. Cheng, C-F. Lin, W-S. Su, "A Sampled-Data Singularly Perturbed Boundary Control for a Heat Conduction System with Noncollocated Observation," *IEEE Transactions on Automatic Control*, Vol. 54, 1305-1310, 2009.
- [29] V. Radisavljevic-Gajic, "Calculation of Feedback Gains for an Optimal Controller," *IMEchE Proceedings Part I, Journal of Systems and Control Engineering*, Vol. 223, 581-584, 2009.
- [30] V. Radisavljevic, "An Alternative Derivations of Al-Alaovi Operator," *IEEE Signal Processing Letters*, Vol. 15, 881-882, 2008.
- [31] V. Radisavljevic-Gajic, "Slow-Fast Decoupling of the Disparity Convergence Eye Movements Dynamics," *Annals of Biomedical Engineering*, Vol. 34, 310-314, 2006.
- [32] V. Radisavljevic-Gajic, "Simple Practical Classical- H_2 Robust Controller," *AIAA Journal of Guidance, Control, and Dynamics*, Vol. 29, no. 6, 417-420, 2006.
- [33] V. Radisavljevic, "A New Feed-Forward/Feedback Scheme for Elimination of Power Transients in Erbium-Doped Optical Fiber Amplifiers," *Dynamics of Continuous Discrete and Impulsive Systems*, Special Issue, Vol. 12, 708-712, 2005.
- [34] V. Radisavljevic and H. Baruh, "A Comparison of Shortening of the Projection to Axial Elasticity", *Journal of Sound and Vibration*, Vol. 276, 81-103, 2004.
- [35] V. Radisavljevic and H. Baruh, "Modeling and Control of Complex Systems and Networks with Differential-Algebraic Equations," *Dynamics of Continuous Discrete and Impulsive Systems*, Special Issue, Vol. 10, 294-299, 2003.
- [36] H. Baruh and V. Radisavljevic, "Modeling of Closed Kinematic Chains with Flexible Links", invited paper, Special Issue in Honor of Professor Meirovitch, *Journal of The Chinese Society of Mechanical Engineers, Transactions of Chinese Institute of Engineers, Part C*, Taiwan, Vol. 21, 1-14, 2000.
- [37] V. Radisavljevic and H. Baruh, "Pointwise Optimal Control of Dynamical Systems Described by Constrained Coordinates" *Transactions of ASME Journal of Dynamic Systems Measurements and Control*, Vol. 121, 594-598, 1999.

Journal Paper Submitted for Publication:

1. V. Radisavljevic-Gajic and Z. Menom, "Simplified Mathematical Model of a Linear Transformers (Two Magnetically Coupled Coils)". Submitted to *IEEE Transactions on Circuits and Systems*, **May 28, 2024**.
2. V. Radisavljevic-Gajic and D. Karagiannis, "Optimal Drug Dosing to Prevent Chemo Therapy Induced Neutropenia". Submitted to *Optimal Control Applications and Methods*, **June 11, 2024**.
3. V. Radisavljevic-Gajic and F. Safieh, "Optimal Performance Loss of an Optimal LQ Controller Driven by a Sylvester Algebraic Equation Designed Reduced-Order Observer". Submitted to *ASME Journal of Dynamic Systems, Measurement, and Control*, **Sept. 1, 2024**.
4. V. Radisavljevic-Gajic, "The Use of Discrete-Time Reduced-Order Observers in Finite Horizon LQ Optimal Control", submitted to *IEEE Control Systems Technology*, **Sept. 3, 2024**.

C. Conference Proceeding Papers:

1. V. Radisavljevic and H. Baruh, "Control of Dynamical Systems Described by Constrained Coordinates," *Proc. AIAA Guidance, Navigation, and Control Conference*, San Diego, California, July 1996.
2. Z. Gajic and V. Radisavljevic, "H2 Linear-Quadratic Optimal Controller with White Noise Optimal Disturbance Rejection," invited paper, *Proc. of International Conference HIPNEF 96*, 205-209, Vrnjacka Banja, Yugoslavia, May 1996.
3. H. Baruh and V. Radisavljevic, "Modeling of Closed Kinematic Chains with Flexible Links", *ASME Mechanics and Materials Conference*, Blacksburg, Virginia, June 1999.
4. V. Radisavljevic and H. Baruh, "Stability and Robustness Analysis of Pointwise Optimal Control", *Proc. American Control Conference*, 3883-3887, Chicago, Illinois, June 2000.
5. V. Radisavljevic and H. Baruh, "A Comparison of Shortening of the Projection to Axial Deformation", *Proc. AIAA Structural Dynamics Conference*, paper 2001-1310, 9 pages, Seattle, Washington, April, 2001.
6. V. Radisavljevic and H. Baruh, "Modeling of Complex Systems and Networks with Differential-Algebraic Equations," *International Conference on Dynamics of Continuous, Discrete, and Impulsive Systems*, Toronto, Canada, May 2003.
7. V. Radisavljevic, "A New Feed-Forward/Feedback Scheme for Elimination of Power Transients in Erbium-Doped Optical Fiber Amplifiers," *Proceedings of the 4th International Conference on Engineering Applications and Computational Algorithms*, 708-712, Guelph, Canada, July 2005.
8. V. Radisavljevic, "Slow-Fast Decoupling of the Disparity Convergence Eye Movements Dynamics," *Proceedings of the 4th International Conference on Engineering Applications and Computational Algorithms*, 713-716, Guelph, Canada, July 2005.
9. V. Radisavljevic, "Rational Placement of Actuators for Linear Optimal Regulators," invited paper, *Proceedings of the International Conference HIPNEF*, 71-77, Vrnjacka, Banja, Serbia and Montenegro, May 2006.
10. V. Radisavljevic, "Disparity Convergence Eye Movements Dynamics under Time Varying Stimuli," *Proceedings of the 32nd Northeast Biomedical Engineering Conference*, 127-128, Easton, PA, April, 2006.
11. V. Radisavljevic, D. Skataric, and S. Koskie, "Linear-Quadratic Full-State Optimal Controller: Theoretical vs Practical," *Proceedings of the International Conference HIPNEF*, 315-320, Vrnjacka Banja, Serbia, Oct. 2008.
12. V. Radisavljevic, and S. Koskie, "Using the Steady State Optimal Gain in the Linear-Quadratic Finite Horizon Optimal Control Problem," *Proceedings of the International Conference HIPNEF*, 303-307, Vrnjacka Banja, Serbia, Oct. 2008.
13. M-B. Cheng, V. Radisavljevic, and W-C. Su, "Sliding Mode Boundary Control of Unstable Parabolic PDE Systems with Parameter Variations and Matched Disturbance: A Lyapunov Approach," *Proceedings of the American Control Conference*, 4085-4090, June 2009.
14. V. Radisavljevic and D. Skataric, "Exact Decoupling of Non-classically Damped Matrix Second-Order Linear Mechanical Systems," *Proceedings of the ASME International Mechanical Engineering Congress & Exposition*, Track 11-3-6, IMECE2009-130056 (8 pages), Orlando, FL, Nov. 2009.
15. V. Radisavljevic and D. Skataric and W-C.Su, "Subsystem Level Optimal Control and Filtering of Non-classically Damped Matrix Second-Order Linear Stochastic Mechanical Systems," *Proceedings of the ASME International Mechanical Engineering Congress & Exposition*, Track-11-3-5, IMECE2009-13053 (9 pages), Orlando, FL, Nov. 2009.
16. V. Radisavljevic-Gajic, "Teaching Linear-Quadratic Optimal Control to Undergraduate Systems," *Proceedings of the American Control Conference*, 378-383, Baltimore, June 2010.

17. M-B. Cheng, V. Radisavljevic, and W-C. Su, "Robust Boundary Stabilization of Uncertain Parabolic PDE Systems with Spatially Varying Coefficients by Using the Sliding Mode Approach," 3341-3346, *Proceedings of the American Control Conference*, June 2010.
18. M-B. Cheng, V. Radisavljevic, T-L. Tsai, and W-C. S, "Output-Feedback Boundary Control of an Uncertain Heat Equation with Noncollocated Observation: A Sliding-Mode Approach," *Proceedings of ICIEA International Conference on Industrial Electronics and Applications*, 2187-2192, Taichung, Taiwan, June 2010.
19. V. Radisavljevic, "Modeling and Control of Dynamic Processes in Fuel and Solar Cells," *Proceedings of the International Symposium on Sustainable Systems and the Environment*, 6 pages, Sharjah, UAE, March 2011.
20. V. Radisavljevic, H. Al Samhouri, O. Odeh, and M. Kassim, "Steady State System Analysis of a Bilinear Fuel Cell Model for Electricity, Heat, and Water Production," *Proceeding of the International Conference on Water, Energy, and Environment*, 6 pages, Sharjah, UAE, Nov. 2011.
21. V. Radisavljevic, A. Muhammad, S. Hoda, and M. Ghatas, "Optimal Observer Driven Controller for a Natural Gas Hydrogen Producing Reformer," *Proceeding of the International Conference on Water, Energy, and Environment*, 6 pages, Sharjah, UAE, Nov. 2011.
22. M. Lee, G-H. Park, and V. Radisavljevic-Gajic, "Modeling of Solid Oxide Fuel Cells: An Overview," *International Conference on Modeling, Simulation, and Applied Optimization*, doi: 10.1109 / ICMSAO.2013.6552683, *invited paper*, Tunisia, April, 2013.
23. M. Leung, G-H. Park, and V. Radisavljevic-Gajic, "Control of Solid Oxide Fuel Cells: An Overview," *Asian Control Conference*, 1896-1901, doi:10.1109/ASCC.2013.6606314, Istanbul, June, 2013.
24. V. Radisavljevic-Gajic, "Linear Observers Design and Implementation," *ASEE-NE 2014 Conference*, paper number 978-1-4799-5233-5/14, Bridgeport, CT, April 3-5, 2014.
25. D. Karagiannis and V. Radisavljevic, "Sliding Mode Boundary Control for an Euler-Bernoulli Beam with Boundary Disturbances and Parameter Variations," *Proceedings of the American Control Conference*, 4536-4542, Portland, Oregon, June 2014.
26. M-B. Cheng, V. Radisavljevic-Gajic, W-C. Su, and U. Ozguner, "A Lyapunov Approach to Second-Order Sliding-Mode Boundary Control of an Unstable Heat System with Spatiotemporal-Varying Parameters under Boundary Disturbance Sliding," *Proceedings of the American Control Conference*, 4530-4535, Portland, OR, June 2014.
27. M-B. Cheng, W-C. Su, V. Radisavljevic-Gajic, U. Ozguner, Sliding Surface Design of Special Class Partial Differential Systems with Boundary Actuators and Matched Disturbances Using a Lyapunov Approach," 6 pages, *SICE Annual Conference 2014*, September 9 - 12, 2014, Hokkaido University, Sapporo, Japan.
28. V. Radisavljevic-Gajic, "A Simplified Two-Stage Design of Linear Discrete-Time Feedback Controllers with Applications to Systems with Slow and Fast Modes," *ASME Dynamic Systems and Control Conference*, San Antonio, Oct. 22-24, 2014.
29. V. Radisavljevic-Gajic, D. Karagiannis, M-B Cheng, and W-C. Su, "Recent Trends in Stabilization and Control of Distributed Parameter Dynamic Systems," *ASME World Congress*, Montreal Canada, Nov. 14-20, 2014.
30. V. Radisavljevic and P. Rose, "Natural Gas Hydrogen Reformer Controller Design with Disturbance Rejection," *ASME Dynamic Systems and Control Conference*, Oct. 28-30, Columbus, OH, 2015.
31. V. Radisavljevic-Gajic, P. Rose, and G. Clayton, "Two-Stage Design of Linear Feedback Controllers for Proton Exchange Membrane Fuel Cells," *ASME Dynamic Systems and Control Conference*, Oct. 28-30, Columbus, OH, 2015.
32. D. Karagainnis, V. Radisavljevic-Gajic, and H. Ashrafiuon, "Control of Human Immunodeficiency Virus (HIV) Dynamics with Parameter Uncertainties," *ASME Dynamic Systems and Control Conference*, Minneapolis, MN, October 12-14, 2016.
33. V. Radisavljevic-Gajic and M. Milanovic, "Three-Stage Feedback Controller Design with Application to a Three-Time Scale Fuel Cell System," *ASME Dynamic Systems and Control Conference*, Minneapolis, MN, October 12-14, 2016.
34. V. Radisavljevic-Gajic and J. K-J. Li, "New Approach to Mathematical Analysis of Linear and Nonlinear Models of the Arterial System," *43rd Annual Northeast Bioengineering Conference*, Newark, NJ, March 31-April 2, 2017.
35. D. Karagainnis and V. Radisavljevic-Gajic, "Robust Boundary control for an Euler-Bernoulli Beam Subject to Unknown Harmonic Disturbances with a Focus on Resonance," *ASME Dynamic Systems and Control Conference*, Tysons Corner, Virginia, October 11-13, 2017.
36. V. Radisavljevic-Gajic, S. Park, D. Chasaki, "Vulnerabilities of Cyber-Physical Control Systems to Sophisticated Attacks," *ASME Dynamic Systems and Control Conf.*, Tysons Corner, VA, Oct. 11-13, 2017.

37. M. Milanovic, P. Rose, V. Radisavljevic-Gajic, G. Clayton, "Five state analytical model proton exchange membrane fuel cell," *ASME Dynamic Systems and Control Conference*, Tysons Corner, VA, Oct. 11-13, 2017.
38. V. Radisavljevic and K. Graham, "Steady state system analysis of a proton exchange membrane fuel cell nonlinear mathematical model," *ASME Dynamic Systems and Control Conference*, Tysons Corner, VA, Oct. 11-13, 2017.
39. D. Karagannis and V. Radisavljevic, "On boundary observation of a simply supported beam via a backstepping design," *American Control Conference*, 3678-3682, Milwaukee, WI, 2018.
40. M. Milanovic and V. Radisavljevic-Gajic, "Optimal linear-quadratic integral feedback controller design for a proton exchange membrane fuel cell," *ASME Dynamic Systems and Control Conference*, Oct. 2018.
41. V. Radisavljevic-Gajic, "Optimal drug dosing to achieve the desired actual neutrophil counts (ANC) in chemotherapy induced myelosuppression," *Conference on Information Science and Systems*, Princeton, March 2022.
42. V. Radisavljevic-Gajic, "Critical analysis of target-mediated drug deposition (TMDD) models," *9th IFAC Conference on Foundations of Systems Biology in Engineering – IFAC PapersOnLine 55-23 (2022) 74-79*, Boston, August 2022.
43. V. Radisavljevic-Gajic, "Machine learning for optimal control of a hydrogen gas reformer used in a PEM fuel," *Proceedings of the International Arab Conference on Information Technology (ACIT2023)*, Ajman, Dec. 6-8, 2023.
44. V. Radisavljevic-Gajic and J. Li, "Software verification of new linear and nonlinear models of the arterial system," *Proceedings of the International Arab Conference on Information Technology (ACIT2023)*, Ajman, Dec. 6-8, 2023.
45. V. Radisavljevic-Gajic, "Discrete-time linear-quadratic optimal controller driven by a reduced-order observer steady state performance loss," *Proceedings of the 2024 ASME Modeling, Estimation and Control Conference, (MECC 2024)*, Chicago USA, in press, Oct. 27-30, 2024.
46. V. Radisavljevic, "Optimal performance loss of the finite-time discrete LQ reduced-order observer-based controller and application to an aircraft," *Proceedings of the IEEE Conference on Decision and Control*, Milano Italy, in press, Dec. 16-19, 2024.
47. V. Radisavljevic-Gajic and F. Safieh, "Optimal Performance Loss of an Optimal Discrete-Time LQ Controller Driven by a Sylvester Algebraic Equation Designed Reduced-Order Observer". Accepted for the International Conference on Electrical, Computer, Communications and Mechanical Engineering, Maldives Nov. 4-6, 2024. Paper due Sept. 30, 2024.

Conference Papers Submitted for Presentation:

1. V. Radisavljevic-Gajic and A. Alaleeli, "Analysis and simulation of some target-mediated drug deposition models," submitted on **Sept. 7, 2024** to American Control Conference, Denver, USA, July 2025.

Grants:

- C. Khachikian (PI), co-PIs A. Pacheco-Vega, V. Crespi, G. Menezes, V. Radisavljevic-Gajic, "Modeling Component of the CREST Center for Energy and Sustainability and the Joint Doctorate in Complex Systems," 06/01/2011-11/30/2012, *National Science Foundation*, \$100,000.
- V. Radisavljevic-Gajic, KEEN the Integrating Curriculum with Entrepreneurial-Mindset (ICE) Workshop. Development of class modules with EML focus. \$2,500, June 2016 – Aug. 2017.
- V. Radisavljevic-Gajic, D. Karagiannis, "Deep Dive EML Workshop". Development of EML projects for ME 5207 Orbital Mechanics and ME 2101 Dynamic Systems I, *Villanova University*, \$6,000.
- V. Radisavljevic-Gajic, Workshop at the American Control Conference 2017 (ACC2017), "Negotiation and Communication Skills for Female Engineers and Faculty," *National Science Foundation*, \$14,569.
- V. Gajic, "Optimal Performance Degradation due to the Use of the Sylvester Full- and Reduced-Order Observer Driven Controllers," \$5,400. Submitted to AU Funded Research Grants Program, submitted April 23, 2023.

NSF Panelist:

- Served as a panelist for the National Science Foundation, Dynamics, Control, and Systems Diagnostics Program (Program Director J. Berg), Arlington, VA, Dec. 10, 2015.
- NSF Panelist for “Smart and Connected Community Planning Grant” proposal review panel (Program Director: David Corman), Arlington, VA, April 4-5, 2017.

Journal Editorials Boards:

International Journal of Engineering Practical Education (IJEPE), Editor, (2012-2019).

Editorial Board of Mechatronics, journal *Frontiers in Mechanical Engineering*. (2015-2019).

Reviewer of Books:

- N. Mallik, *System Dynamics and Control Engineering: Basic and Advanced Treatments*, Bentham Science Publishers, Aug. 2009.
- M. Haidekker, *Linear Feedback Controls*, 2nd edition, Elsevier. Editor Yuri Sonnini, Dec. 2017.

Reviewer of Journal Papers:

AIAA Journal of Guidance, Control and Dynamics (1998-present)

International Journal of Systems Science (2000-present)

Dynamics of Continuous, Discrete, and Impulsive Systems (2002-present)

Automatica (2002-present)

International Journal of Control (2002-present)

IEEE Transactions on Automatic Control (2003-present)

ASME Journal of Dynamic Systems, Measurements and Control (2003-present)

Annals of Biomedical Engineering (2005-present)

Proc. of IME, Journal of Systems and Control Engineering (2008-present)

IEEE Transactions of Biomedical Engineering (2008-present)

Proc. of IME, Journal of Multi-body Dynamics (2008-present)

Proc. of IME, Journal of Mechanical Engineering Science (2008-present)

Proc. of IME, Journal of Automobile Engineering (2008-present)

Signal Processing Letters (2008-present)

IMA Journal of Mathematical Control and Information (2009-present)

IEEE Transactions on Education (2009-present)

Systems and Control Letters (2009-present)

Nonlinear Analysis Series B: Real World Applications (2009-present)

Mathematical Problems in Engineering (2010-present)

IEEE Transactions on Control Systems Technology (2011-present)

International Journal of Mathematics and Mathematical Sciences (2012-present)

International Journal of Robust and Nonlinear Control (2012-present)

SIAM Journal of Control (2012-present)

Journal of the Franklin Institute (2013-present)

International Journal of Engineering Practical Research (2013-present)

IET Control Theory and Applications (2013-present)

Mathematical Problems in Engineering (2013-present)

Journal of Intelligent and Fuzzy Systems (2014-present)

IEEE Control Systems Magazine (2015-present)

Proc. IMech Journal of Mechanical Engineering Science (2015-present)

Journal of Vibration and Control (2015-present)

IETE Journal of Research (2016-present)

IEEE Transactions on Control of Network Systems (2016-present)

Applied Energy (2017-present)

Journal of Intelligent and Fuzzy Systems (2017-present)

SIAM Journal of Applied Mathematics (2017-present)

IEEE Transactions on Nuclear Science (2018-present)

IEEE Access (2018-present)

IEEE Transactions on Industrial Electronics (2018-present)

IEEE Control Systems Letters (2019-present)

International Journal of Hydrogen Energy (2019-present)
Energies (2020-present)
Scientific Reports (2024-present)

Reviewer of Conference Papers:

- ASME Dynamic Systems and Control Conference, 2014, 2015, 2016, 2017.
- Control Decision Conference, 2000, 2002, 2009, 2012, 2015, 2024
- American Control Conference 2003, 2007, 2011, 2015, 2016, 2018, 2024.
- European Control Conference, 2018, 2019.
- International Arab Conference on Information Technology ACIT 2023, Ajman, Dec. 6-8, 2023. Oct. 2023.
- GLOBECOM 2003
- DCDIS 4th International Conference on Engineering Applications and Computational Algorithms, 2005.
- 32nd Northeast Biomedical Engineering Conference, 2006.
- ASME International Mechanical Engineering Congress & Exposition, Orlando, Florida, 2009.
- 5th IEEE Conference on Industrial Electronics and Applications, Taichung, Taiwan, June 2010.
- IFAC (International Federation of Automatic Control) World Congress, Milano, Italy, 2011.
- IFAC 7th Symposium on Robust Control Design, Aalborg, Denmark, June 2012.
- IEEE Multi-Conference on Systems and Control, Dubrovnik, Croatia, October 3-5, 2012.
- International Conference on Modeling, Simulation, and Applied Optimization, Tunisia, April, 2013
- IMACE Conference, ASME World Congress Nov. 2014.
- IFAC Conference on Modeling, Identification and Control of Nonlinear Systems, MICNON-2015.
- International Conference on Electrical and Control Engineering ECECE 2015, Beijing, China, 2015.
- International Conference on System Theory, Control and Computing, Romania 2015.
- Mediterranean Control Conference 2017.
- Conference on Control Technology and Applications CCTA 2017
- IEEE International ICCCT2017, Conference, Chengdu, China, Dec. 2017.
- International Arab Conference on Information Technology ACIT 2023, Ajman, Dec. 6-8, 2023.

Conference Session Chair:

- DCDIS 4th International Conference on Engineering Applications and Computational Algorithms,
Session: "Control of Networks and Systems," Guelph, Ontario, Canada, July 2005.
- 32nd Northeast Biomedical Engineering Conference, Easton, Pennsylvania, April, 2006.
Session: Signals and Systems I
Session: Signals and Systems II
- ASME Congress, Orlando, Florida, Nov. 2009.
Session: Vibration and Control.
- ICWEE 2011, International Conference on Water, Energy, and Environment, Nov. 2011.
Session: Thermal Energy Recovery
Session: Fuel and Solar Cells
- International Conference on Modeling, Simulation, and Applied Optimization, Tunisia, April, 2013.
Session: Mechanical Engineering-1
Session: Mechanical Engineering-2
Session: Mechanical Engineering-3
- American Control Conference, Portland, Oregon, June 4-6, 2014.
Session: Variable Structure Control.
- ASEE-NE 2014 Conference, April 3-5, 2014, Bridgeport, CT.
- ASME Dynamic Systems and Control Conference, San Antonio, Oct. 22-24, 2014.
Session: New Perspectives on Control System Design.
- Session Chair, *ASME Dynamic Systems and Control Conference*, Minneapolis, MN, Oct. 12-14, 2016.
- Workshop Organizer "Negotiation and Communication Skills for Female Engineering Faculty and Students", American Control Conference (ACC2017), Seattle, WA, June 2017.
- Program Committee Member, ASME Dynamic Systems and Control Conference, Tysons Corner, VA, Oct. 11-13, 2017.
- Judge for the Best Student Paper Award, ASME Dynamic Systems and Control Conference, Tysons Corner, VA, Oct. 11-13, 2017.
- Session Chair: Multi-agent and Networked Systems II, ASME Dynamic Systems and Control

- Conference, Tysons Corner, VA, Oct. 11-13, 2017.
- Session Chair: Modeling and Validation I, ASME Dynamic Systems and Control Conference, Tysons Corner, VA, Oct. 11-13, 2017.
 - Program Committee Member, 3rd IEEE International ICCS 2017 Conference, Chengdu, China, Dec. 13-16, 2017.
 - Co-organizer of a technical session: “Vibratory Systems,” with Professors Zheng (SUNY Buffalo), Zuo (Virginia Tech), and Tang (University of Connecticut) at the American Control Conference, Milwaukee, WI, June 2018.
 - Session Chair: Dynamics and Control of Renewable Energy Systems, ASME Dynamic Systems and Control Conference, Atlanta, Georgia, Oct. 2018.
 - Session co-Chair: Invited Session: Vibrations – Modeling, Analysis, and Control I, ASME Dynamic Systems and Control Conference, Park City, Utah, Oct. 8-11, 2019.
 - Session co-Chair: Invited Session: Vibrations – Modeling, Analysis, and Control II, ASME Dynamic Systems and Control Conference, Park City, Utah, Oct. 8-11, 2019.
 - Section: “Engineering Applications, International Arab Conference on Information Technology,” ACIT 2023, Dec. 6-8, Ajman University, Ajman, UAE.
 - Section: Observers for Linear Systems”, Control Decision Conference (CDC) 2024, Milano Italy, Dec. 16-19, 2024.

Conference Program Committee Member:

- 32nd Northeast Biomedical Engineering Conference, Easton, Pennsylvania, April, 2006
Technical Program Review Committee
- International Conference on Modeling, Simulation, and Applied Optimization, Tunisia,
Track Chair for Mechanical Engineering, April, 2013.
- International Conference on Engineering and Technology (ICET2013), Sanya, Hainan, China,
Dec. 13-15, 2013.
- 2014 International Conference on Nano Science and Technology (NST 2014), Lushan, Jiangxi, China
May 16-18, 2014.
- Technical Program Committee, International Conference on Engineering Science and Technology
(ASSE-EST 2014), Qingdao, Shandong, China, Oct. 31 - Nov. 2, 2014.
- Student Poster Committee: ASEE-NE 2014 Conference, April 3-5, 2014, Bridgeport, CT.
- Technical Program Committee Member: 6th International Conference on Electrical and Control
Engineering, ECECE 2015, Beijing, China, July 20-21, 2015.
- Program Committee Member, ASME Dynamic Systems and Control Conference, Oct. 11-13, 2017.
- International Arab Conference on Information Technology, ACIT 2023, Ajman University, Ajman, UAE, Dec.
6-8,2023.
- 2024 International Conference on Climate Change and Sustainable Development (CCSD 2024), Sanya, China,
Nov. 16-17, 2024.
- 2024 International Conference on Artificial Intelligence and Smart Transportation Systems (AISTS 2024),
Shanghai, Oct. 19-20, 2024.

Member of Professional Societies:

Member of ASME since 2004.
Member of ASEE since 2013.
Member of IEEE since 2013.

Doctoral Dissertation Supervised:

- [1] Dimitrios A. Karagiannis, *Boundary Control and Observation of Continuous Beam Systems*, (published four journal papers and five conference papers). Won the best paper award at DSCC 2017 conference in the area of vibrations. Graduated in May 2018. Presently, Teaching Assistant Professor at Temple University.
- [2] Milos Milanovic, *A Novel Multi-Stage Controller Design Technique for Partial Optimal Control of Linear Systems with Applications to Proton Exchange Membrane Fuel Cells* (published book, three journal papers, and three conference papers). Graduated in 2019. Recipient of the College of

Engineering Doctoral Program Award. Graduated in May 2019. Presently a Senior Engineer, ASML Company, CT.

Master Thesis Supervisions

- 1) Patrick Rose, *Mathematical Modeling and Control of a Proton Exchange Membrane Fuel Cell*, Nov. 2015.

Member of Doctoral Dissertation Committees

- 1) S. Bang, *Minimizing Nonlinearities in DWDM Communication Network System*. Advisor Professor D. Daut, Rutgers University, Department of Electrical and Computer Engineering, Oct. 2006.
- 2) Ryan Elkholy, *Novel Multi-Electrode Probe with Three-Dimensional Spatial Resolution Capable of Simultaneous Recording/Stimulation for Use in Long-Term Adaptive Deep Brain Stimulation Treatment*. Advisor Professor L. Tzanakou, Rutgers University, Department of Biomedical Engineering, May 2011.
- 3) Emir Elkholy, *Novel Neurochip Design Implementing ALOPEX for Use in an Automated Deep Brain Stimulation System for Parkinson's Patients*. Advisor: Professor L. Tzanakou, Rutgers University, Department of Biomedical Engineering, May 2011.
- 4) Masood Ghasemi, *Design of Cooperative Control Algorithms for Multi-agent Systems*, in progress. Adviser: S. G. Nersesov, Villanova University, Nov. 2013.
- 5) Ph. D. Proposal Defense Chair for Ryan Lee, Chemical Engineering, Villanova University, July 2014.

Member of Master Thesis Committees

1. Artin Mejj Davidian, *Pedal Powered Wheelchair for Stroke Survivors*, (Advisor Prof. S. Landsberger), California State University, Department of Mechanical Engineering, June 2010.
2. Dimitrios A. Karagiannis, *Boundary Control of Harmonic Disturbances on Flexible Cantilever Beams Using Piezoelectric Patch Actuators*, Advisors: G. Clayton, and C. Nataraj, Villanova University, Nov. 2012.

Invited Lectures and Talks

- 1) "Properties of Feedback Control Systems"
Lafayette College, Easton, Pennsylvania, March 2004;
Midwestern State University, Wichita Falls, Texas, March 2006.
- 2) "Electronic Control of Photon Power Transients in Erbium-doped Optical Fiber Amplifiers"
Northeastern University, Boston, Massachusetts, March 2006.
- 3) "Classical and Modern H_2 Robust Controllers"
New Mexico State University, Las Cruces, NM, April 2006.
Manhattan College, New York, NY, May 2006.
- 4) "Modeling of Cell Calcium Dynamics"
US Army Medical Research, Frederick, MD, March, 2007.
- 5) "A Practical LQ and H_2 Optimal Controller with Applications to Cars and Aircrafts"
United Technology Research Center, Hartford, CT, June 2007.
- 6) "A Practical Linear-Quadratic and H_2 Optimal Controller"
Princeton/Central Jersey Section of IEEE Meeting, Rutgers University, Piscataway, Dec. 2007.
Bucknell University, Lewisburg, PA, March, 2008.
California State University, Los Angeles, April, 2009.
- 7) "Mechatronics and Control of Optical Fiber Amplifiers"
North Carolina State A&T University, Greensboro, March 2009.
- 8) "Decoupling and Optimal Control of Non-Classically Damped Second-Order Mechanical Systems"
University of California at Berkeley, March 2009.
- 9) "Modeling and Control of Complex Dynamic Systems"
Villanova University, April, 2012.
Rutgers University, School of Engineering Seminar in Control Systems and Robotics, Oct. 2012.
- 10) "Sliding Mode Control of Distributed Parameter Systems," Rutgers University, Mechanical and Aerospace Engineering Colloquium Series, April 2015.

Educational and Professional Conferences/Workshops/Activities

- VITAL Workshop Nov. 16, 2012 (“*What Do We Want Our Students to Learn, and How Do We Know That They’ve Learned It? Differentiating Among the Good, the Bad, and the Fuzzy*”).
- TechExpo: April 11 2013: *Flipped Learning in a College Classroom— Lessons Learned*.
- VITAL Workshop “*Teaching and Learning Strategies at Villanova 2013*”. May 15, 2013
 - Recognizing Our Students’ Mental Health Problems.
 - Enticing Undergraduate Students to Pursue Graduate Research at Villanova.
 - Reinforcing Fundamentals in Environmental Engineering through Interactive Teaching.
 - Experiences with an Inverted Classroom: Lessons from Versions 1.0
 - So...What if They Don’t Take Notes.
 - Improving Pedagogical Skills by Knowing Students’ Learning Styles.
- Engineering Advisor Workshop, 09/06/2013.
- Attended a workshop on education, “*National Effective Teaching Institute (NETI-1B)*,” New Orleans, January 4-6, 2014.
- Attended “*Writing & Designing NSF Proposals Workshop*” at Columbia University, 01/31/2013.
- Attended the Workshop “*Coach*” in Dallas, March 15, 2014.
- Participated in “*Girls Scouts Day*,” March 22, 2014, Villanova University.
- Invited to attend the *2014 NSF Career Proposal Writing Workshop*, University of Maryland, College Park, April 7-8, 2014.
- Judge at the high school student robotic competition. Rowan University, May 11, 2014.
- Presented a talk “Active Learning as a Transition towards the Inverted Classroom in STEM Courses,” at *VITAL 2014 Teaching and Learning Strategies at Villanova Workshop*, 05/15/2014.
- Attended “Philadelphia Women in Leadership Symposium,” Villanova University, 07/31/2014.
- Moderator for a book discussion “The Other Wes Moore: One Name, Two Fates,” with incoming students during New Student Orientation. 08/22/2014.
- Participated in “The House Call: Connecting the Campus One Student at a Time,” Sept. 17, 2014.
- Participated in “IEEE Global Virtual Mini-Conference on Early Career Faculty Development: Effective Teaching,” Sept. 18, 2014.
- Took an online course “Evidence-Based Undergraduate STEM Learning” within the MOOK Program, and participated in the corresponding VITAL learning community (Fall semester).
- Participated in “Villanova Women Networking Event,” Sept. 24, 2014.
- Participated in VITAL’s “Supporting Inclusive and Interactive Classrooms,” Oct. 20, 2014.
- Participated in “Northeast E-Learning Consortium Conference” held at Villanova, Nov. 6, 2014.
- Participated in “*Girls Scouts Day*,” March 21, 2015, Villanova University.
- Participated in "STEM Success for Women: Empowering Educators to Recruit and Retain More Women in STEM" Tele-summit on April 13-16, 2015.
- Participated in MATE as a poster judge. Marine Advanced Technology Education (MATE) is a National Science Foundation-supported organization that encourages maritime STEM learning, May 9, 2015.
- Participated in Kaplan NSF Career Proposal Writing Workshop, June 10, 2015.
- Attended Teaching Workshop Sponsored by VITAL: “Motivating and Engaging Your Students – Strategies for Teaching from the Psychology of Learning,” by Todd Zakrajsek, UNC-Chapel Hill, Sept. 28, 2015.
- Attended the Clare Boothe Luce Workshop, New York, Nov. 7-8, 2015.
- Participated and gave a presentation to 4th and 5th graders during a half day outreach event “Engineering is for Girls,” organized by Villanova University Department of Mechanical Engineering, April 2, 2016.
- Participated in DOE Webinar: “Hydrogen Fuel Cells for Unmanned Air Vehicles,” May 26, 2016.
- Participated in “Integrating Curriculum with Entrepreneurial-Mindset (ICE) Workshop, Dearborn MI, June 7-9, 2016.
- Attended a workshop on Smart Grid, American Control Conference, Boston, MA, July 5, 2016.
- Attended “Women in Control,” committee organizational meeting at the American Control Conference, Boston, MA, July 7, 2016.
- Attended workshop “Couch-to-Couch,” Philadelphia, August 16, 2016.
- Participated in DARPA Webinar for the DARPA Career Award, October 3, 2017.
- Ajman University Women Empowerment Council
- Al Ain trip AU with female students to participate in a project competition, June 1, 2024.

- International Women in Engineering Day, Panelist. Trip to the Engineering Society of UAE, Al Mazar (Sharjah) trip with 24 Ajman University female engineering students, June 23, 2024.

TEACHING STATEMENT

Teaching Philosophy and Approach. My teaching philosophy is to inspire students to become passionate and curious about the material taught while helping them develop their self confidence in the large and competitive mechanical engineering. To do this, I provide students with thorough practice and exercise to reinforce and expand on material covered in lectures as well as regular quizzes to ascertain if there are any common problem areas that require extra explanation. Likewise, I believe that engaging students with hand on work such as experiments and projects helps to further link concepts with real world scenarios and assists in making relatively obscure concepts more tangible. To motivate students to achieve their full potential, my exams, in addition to standard text book problems, contain a challenge section that requires students to apply their knowledge of the material in new and innovative ways. I prefer to give regular quizzes to test student's knowledge of theoretical concepts in order to make the learning process as continuous as possible. I make every effort to be open and friendly with students and to assist them in their academic needs by regularly being available for questions and discussions. I am always seeking ways to improve the effectiveness of my teaching and to help students achieve their full potential. I have participated in a number of STEM teaching workshops. These workshops have inspired me to incorporate active learning techniques into my undergraduate classes to enhance students' active class participation and knowledge retention. To further encourage undergraduate involvement in hands on research, I have developed the fuel cell clean energy laboratory for use in teaching undergraduate students and graduate student research. My teaching interests include also developing educational methods for engineering students, especially introducing undergraduate students to modern and advanced topics present in real world scenarios. To this end, I have published a journal paper on the implementation of linear dynamic observers using the software packages MATLAB and SIMULINK for computer aided control system design. Another paper of mine on the design of optimal controllers for engineering students and practicing engineers has been submitted. In summary, my teaching philosophy is to help students achieve personal, professional and academic growth through building strong self-confidence and perseverance.

Examples to Support the Teaching Philosophy. I strongly believe that formative assessment is needed in order to ensure that my students are mastering the course material well. Even more importantly, formative assessment aids the students in building self-confidence while developing their problem solving skills. My assessment begins with challenging homework problems, where the final answers are supplied so that students know they are on the right track while also providing students with valuable feedback on how well they have mastered class material without significant impact on their final grade. In some cases, students have asked for additional quizzes. Adopting formative assessment has had a significant positive impact on the student performance on exams, which was reflected in their final grades. This motivated me to start attending teaching workshops, such as NETI-1A, VITAL, and events. All these activities helped me learn about many different learning styles, active learning, project based learning, and EML activities. These activities helped me transform my classes into more student engaging, hands on activates. Most of my classes incorporated short videos from real life that were related to the lecture topic. For example, we watched video about slippery curved roads and tried to understand why they are more dangerous than straight roads. The rest of the lecture we worked on theory behind this problem and explore what we can do to improve these conditions and reduce the number of accidents.

In order to further promote group discussion I prefer to focus on strengths of individual comments. When an answer is incorrect, instead of dismissing the student, I focused on any correct portion in their response and guide the student to the correct answer. In addition, I offered students the option to excuse themselves when called up to help with problem solving in order to alleviate performance anxiety that may potentially lead the student to avoid attending the lecture. Finally, bonus points were offered for class

participation in order to further reinforce discussion. Through all of these efforts, I have observed a growth, not only in discussion but also student confidence. One of my goals as a teacher is to make sure that *my students know that I am always available if they need help*. In order to support my students through their learning process, I have had regular office hours and organized study sessions almost every week. During these study sessions, students were encouraged to work on their own, and I served to help them develop their thinking processes and problem solving approaches. The goal for these study sessions was to help them develop their own critical thinking skills for problem solving. Students had very positive feedback about my office hours and study sessions.

Teaching Innovations using Instructional Technology. I post regularly all course materials on Internet, using for example Blackboard. I am familiar with the Distance Learning technology and I have taught three times Advanced Dynamics as a long distance learning course. My lectures were recorded, and I used this technology to record additional material, such as course review material, and additional problems with detailed explanations. Students found these additional resources very helpful. Another benefit of instructional technology is the ability to show videos during lecture that help relate theory to real life applications. In addition, I started delivering lectures using a tablet instead of writing on the board. This new method enabled me to have the complete presentation available during the lecture to refer to particular parts when they are needed, or when students ask questions. These lectures were then made available to students. When MATLAB programming exercises are included in the lecture, the tablet is quite valuable, allowing simultaneous programming and the theory presentation behind it.

SCHOLARSHIP STATEMENT

My research utilizes mathematics to describe dynamics of mechanical systems that I intend to model and control. To avoid relying too heavily on mathematics in an engineering field, I demonstrate my research results on real world engineering problems via simulation and verification of the developed theory using computer packages for control system design. Moreover, since the development of the new clean energy proton exchange membrane fuel cell laboratory at the Villanova University, I am able to experimentally verify my newly obtained theoretical research results. Having given a mathematical model of a dynamic systems, in general, I can work on the development of desired control strategies irrespectively to the nature of that system (mechanical, electrical, biological,...). With my broad knowledge of mathematics, from linear and nonlinear ordinary differential equations to partial differential equations, I can work in a very broad field of real physical systems. My main research interests have been in the following areas: (a) Multi-stage feedback control and multi-time scale dynamic system modeling with applications to proton exchange membrane fuel cells. This type of fuel cell is used in electric cars to produce electricity from hydrogen rich fuels without burning said fuel (Honda Clarity FCX, Hyundai Tuscon, Toyota Mirai FCV, Mercedes-Benz B-class); (b) Control, dynamics, and modeling of systems described by partial differential equations with applications to heat transfer and vibration suppression in beams; (c) Dynamics, modeling and control of bioengineering systems and processes (HIV-virus, eye movement, arterial system); (d) Control, modeling, and dynamics of complex systems described by differential-algebraic equations including robots, vehicles, aircraft, drones, flexible structures, and networks; approximate (adaptive) dynamic programming and reinforcement learning.

Research Projects:

Modeling and Control of Processes in Proton Exchange Membrane Fuel Cells. In this project, my master student Patrick Rose and I designed full- and reduced-order observer driven controllers for fuel cells (firstly for proton exchange membrane (PEMFC)). The obtained controllers can with minor modifications be used for solid oxide fuel cells (SOFC) and hydrogen gas reformers (fuel processing system, which produce hydrogen from natural gas or from other hydrogen rich fuels). Due to the complexity of the system, the design requires multiple feedback control loops and feed-forward controllers, firstly to cope with the impact of the disturbance caused by the produced fuel cell current (the current changes at random time instances as a piecewise constant), secondly to provide proper anode and

cathode pressures, and finally to provide the desired fuel cell performance from the optimal control point of view. Since fuel cells and hydrogen gas reformers have complex physical, chemical, and electrochemical interactions evolving in multiple time scales the challenging tasks will be to implement controllers and corresponding observers to operate independently in different time scales. The controllers designed will be verified both in simulation using MATLAB/SIMULINK and experimentally at the Villanova University Fuel cell Laboratory. Mr. Patrick Rose's master thesis (defended in Nov. 2015) was based on the results obtained during the course of this project. We have jointly published a paper in the *International Journal of Hydrogen Energy* and three conference papers. Upon graduation of Mr. Rose, my doctoral student Milos Milanovic continued research on this project. Mr. Milanovic has recently graduated with his doctoral degree. We have published another journal paper on control of PEM fuel cells in *Transactions on ASME Journal of Dynamic Systems, Measurement, and Control*. We have discovered that fuel cells, due to their complex physical nature operate in several time scales and that they could be efficiently controlled in several stages. This has led the second research project described in the next item.

Design of Multi-Stage Multi-Time Scale Feedback Controllers. We have considered how to design and simplify two-stage full-state or output feedback controllers with local controllers acting on particular parts (subsystems) of the system. This is particularly important for systems composed of two subsystems operating in different time scales (for example fuel cells). I published two papers in the *ASME Journal of Dynamic Systems Measurement and Control* in 2015 on this topic, and another one in the same journal coauthored with my doctoral student Mr. Milanovic in 2017. In the 2017 paper, we have successfully extended the two-stage, two-time scale results to three-stage, three-time scale systems and applied the obtained results to an eighth-order proton exchange membrane fuel cell model that is used to produce electricity for electric cars. Our future research goal is to extend this methodology to general multi-stage multi-time scale systems and to design independent and novel partial-state or partial-output feedback controllers for different subsystems of the system under consideration. The overall full-state feedback controller will be designed as a combination of individual subsystem controllers in a proportional full-state or output feedback form. Since controller implementation is usually in the digital form, we will consider both the design of the corresponding continuous- and discrete time multi-stage multi-time scale feedback controllers. My former master student Mr. Rose and my former doctoral student Dr. Milanovic, (he graduated in April 2019) and I published a book with *Springer* in Feb. 2019 on multi-stage multi-time controller designs.

Control and Stabilization of Distributed Parameter Systems. My former doctoral student Dimitrios A. Karagiannis, and I are addressing the challenge of stability and control of an Euler-Bernoulli *beam* with various boundary conditions. The controller is given in the form of an applied displacement and bending moment that accounts for bounded exogenous disturbances, representing a number of possible practical issues such as model parameter uncertainties or unknown external forces. I am currently working on developing sliding-mode boundary control of an uncertain *heat system* with spatially dependent coefficients. This system is modeled as a partial differential equation subject to both an exogenous disturbance at the control end and parameter variations within the interior domain. The objective is to design a sliding mode controller and an infinite-dimensional sliding surface that ensures system stability in the sliding mode and forces the system states to move toward the sliding surface and remain on it. In addition, I am interested in studying sliding mode control for output-feedback boundary stabilization of the unstable heat equation with matched disturbances using noncollocated sliding mode observers. The system model describes conduction of a thin rod using a parabolic partial differential equation with a Dirichlet type boundary actuator and sensing at the opposite end. The sliding mode controller will be designed to effectively drive the system states to an exponentially stable infinite-dimensional sliding surface which then eliminates the system vibration with arbitrary damping. Jointly with Dr. Karagiannis (he graduated in May 2018), we have published four journal papers and presented five conference papers on this topic. The conference paper won best paper award at ASME Dynamic Systems and Control Conference 2017. Two journal papers were published in *IEEE Transactions on Automatic Control*, and one paper in *Journal of Vibrations and Control*, and *Journal of Sound and Vibrations*.

Modeling and Control of HIV Dynamics and Dynamic Processes in Human Body. Modeling and control of HIV dynamics was my research area before I joined the Villanova University. I published a paper in *Annals of Biomedical Engineering* in 2009. Since this is still a very active research area I will put more time to that end if a graduate student is interested in doing either a master thesis or a doctoral dissertation. Modeling of HIV dynamics and its analysis and control is a very active and challenging research area that involves numerous researchers from diverse fields of science and engineering. I am interested in developing new mathematical models of HIV-virus dynamics and new efficient control strategies to keep the number of HIV virions under a pre-specified level and to reduce the total amount of medication that patients receive. The main idea is based on an early introduction of protease inhibitors (PI) drugs to patients infected with the HIV-virus. However, in practice, the first line of HIV therapy is the administration of reverse transcriptase inhibitors (RTI) drugs (which are less expensive) while the second line of therapy are expensive PI drugs. I also plan to model dynamics of RTI and PI drugs and couple it with HIV dynamics in a single mathematical model. This will require knowledge from several scientific disciplines, such as systems biology, molecular biology, and pharmacodynamics. I plan to use the theory of multiple time scales to study HIV dynamics in fast (initial infection phase) and slow (quasi steady state) time scales. I hope that this fast/slow decomposition will help us to get a better understanding of the initial infection since there are many biological steps between HIV infection and the production of new HIV virions. Multi-time scaling modeling will also be used to capture slow decay of the patient's immune system and the slow dynamics of the corresponding model parameters coupled with the fast dynamics that represents healthy and infected white blood cells.

Modeling and Control of Processes in Pharmacokinetics and Pharmacodynamics. In the recent years optimal chemotherapy dosing using a result from optimal control theory in order to reduce the amount of administered chemotherapy drugs and to keep the number of neutrophil cells above a pre-specified desired ANC (actual neutrophil count) level has become an important research area. My approach to this problem shows that in the *case of continuous dosing, the variable optimal amounts of the drug have to be administered daily based on information regarding the actual count of neutrophils. This result mathematically establishes that administering constant amount of drugs daily cannot provide the optimal dosing schedule.* In general, the obtained results open a door for modern personalized and optimized medicine that requires daily monitoring of fundamental variables and daily drug administration in *variable quantities* based on the actual state of the patient's fundamental variables (parameters) for the considered disease. In addition, I have recently started analyzing mathematical models developed for target-mediated drug deposition, so-called TMDD models.