

Joel M Esposito, Assistant Professor

Date of Rank: 08/15/2002, Total Years at USNA: 4.5

Tenure Clock Started: 08/15/2002

1. EDUCATION

Ph.D. Mechanical Engineering, University of Pennsylvania, Philadelphia, PA, December 2002

M.S. Mechanical Engineering, University of Pennsylvania, Philadelphia, PA, May 1999

B.S. Mechanical Engineering, Rutgers University, New Brunswick, NJ, May 1997,
Magna cum Laude

2. EMPLOYMENT

Associate Professor, Department of Weapons and Systems Engineering, US Naval Academy, Annapolis, MD, (8/2007 – Present)

Assistant Professor, Department of Weapons and Systems Engineering, US Naval Academy, Annapolis, MD, (8/2002 – 8/2007)

Graduate Research Fellow, General Robotics and Active Sensory Perception Laboratory, Univ. of Pennsylvania, Philadelphia, PA, (6/1998 – 8/2002)

Research Engineer, Robotics and Manufacturing Center, Sandia National Laboratories, Albuquerque, NM, (6/1999-9/1999)

Teaching Assistant, Dept. of Mechanical Eng., University of Pennsylvania, Philadelphia, PA (9/1997 – 5/1999)

Failure Analysis Engineer, Lockheed-Martin, Missiles and Space Division, East Windsor, NJ, (6/1997 – 9/1997)

Research Assistant, Department of Mechanical Engineering, Rutgers University, New Brunswick, NJ, (9/1996 – 5/1997)

National Science Foundation REU Scholar, Boston University, Boston. MA, (6/1996-9/1996)

3. TEACHING

a. Courses Taught and Coordinated at USNA

AY	FALL	SPRING
02-03	ES301, ES301, ES307	ES302, ES302, ES308
03-04	ES301, ES307	ES302, ES308
04-05	ES301, ES301 (C)	ES302, ES302, ES308
05-06	ES301, ES301(C) , ES450	ES308, ES308, ES486A (CT)
06-07	ES301 (C), ES450, ES450	

Key: C: Course Coordinator
T: Team taught

ES307 Linear Control (4,0,4)
ES308 Control Lab (1,2,2)

ES486A Autonomous Vehicles (2,2,3)	ES486A Autonomous Vehicles (2,2,3)
ES301 Dyn. Modeling & Simulation (2,2,3)	ES302 Applied Control Sys. (2,2,3)

b. Significant Course and Laboratory Development:

ES301 Dynamic Systems Modeling and Simulation

- Shepparded transition of pedagogical approach in response to departmental consensus, from network approach to physics-based approach.
- Developed lecture notes and summary sheets on physics based modeling of basic mechanical, electrical, fluidic and thermal systems.
- Developed handouts and in class exercises on basic modeling skills such as producing transfer functions, state space equations, simulation diagrams and numerical integration.
- Developed a new sequence of 8 new hardware-based laboratory exercises to give students more hands-on experience in modeling physical systems.
- Developed a series of non-traditional homework problems designed to encourage creative and intuitive thinking about engineering systems.
- Coordinated the purchase of \$75,000 of new laboratory equipment.

ES302 Measurement and Instrumentation

- Development of laboratory exercises using AD converters.
- Development of laboratory exercises using Rabbit Microprocessor to statistically process measurement data.

ES486A Autonomous Vehicles

- Team developed novel syllabus and laboratory outline for a new course offering
- Administrated new course offering in Spring 2005, including catalogue listing, laboratory equipment purchase, recruiting, and scheduling 5 faculty and guest lecturers.
- Developed a set of lecture notes on advanced kinematics and rigid body dynamics for autonomous vehicles.
- Various laboratory development contributions on topics such as: Euler Angles, Inertial Measurement, Dynamic Simulation
- Developed final course project on autonomous control of a remote-control scale hovercraft.

c. Adviser Student Theses

Trident Scholar Co-Adviser: Erik Smith, USNA class of 2007

Independent Study ES495: Joseph McCook, USNA Class of 2007

PhD Student Co-Adviser: Jongwoo Kim, University of Pennsylvania class of 2006

MS Student Co-Adviser: Ghananeel Nighojkar, Wichita State University class of 2007

Trident Scholar Adviser: Thomas Dunbar, USNA class of 2005

PhD Student Committee Member: Jing Ren, University of Western Ontario, class of 2005

Cap Stone Project Adviser: Approximately 10 First Class Systems Engineering design project groups including topics such as Systems Ball robots, Lacrosse Ball Automatic Return, Advanced Baseball Pitching Machine, Tugboat Control and Rotor craft controller.

d. Previous Teaching Experience:

Teaching Assistant, Dept. of Mechanical Eng., University of Pennsylvania (9/1997 – 5/1999)

Peer Tutor, Learning Resource Center, Rutgers University, (9/1995 – 5/1997)

4. SCHOLARSHIP

Peer Reviewed Journal Articles:

- J8. **J.M. Esposito**, and V. Kumar, “Event detection near singularities”, *ACM Transactions on Modeling and Computer Simulation*, Volume 17, Issue 1, p. 1-22, January 2007
- J7. J.W. Kim, **J.M. Esposito** and V.Kumar, “RRT enhancements” *International Journal of Robotics Research*, Vol 15 Issue 12, p 1257-1272, Dec 2006
- J6. **J.M. Esposito**, and M. Kim, “Using formal modeling with an automated analysis tool to design and parametrically analyze a multi-robot coordination protocol: a case study”, Accepted for publication in *IEEE Transactions on Systems, Man and Cybernetics: Part A, Systems*. Vol 37, Issue 3, May 2007 Page(s): 285-297
- J5. **J.M. Esposito**, M.G. Feemster and J. Watkins, “Role of Matlab real-time hardware interface within a systems modeling course”, *ASEE Computers in Education Journal* , Vol. 16, No.1, p. 41-50, Jan. 2006
- J4. C. Belta, **J.M. Esposito**, J. Kim, V. Kumar. “Computational techniques for analysis of genetic network dynamics”, *International Journal of Robotics Research*, Volume 24 Issue 2-3, p.219-239, March-April 2005
- J3. **J.M. Esposito** and V. Kumar, “An Asynchronous Integration and Event Detection Algorithm for Simulating Multi-Agent Hybrid Systems”, *ACM Transactions on Modeling and Computer Simulation*, Volume 14, Issue 4, p. 336-358, October 2004
- J2. R. Alur, T. Dang, **J.M. Esposito**, Y. Hur, F. Ivancic, V. Kumar, I. Lee, P. Mishra, G. J. Pappas, and O. Sokolsky, “Hierarchical modeling and analysis of embedded systems” *Proceedings of the IEEE*, Vol. 91, No. 1, p.11-28, January 2003.
- J1. R. Alur, A. Das, **J.M. Esposito**, R. Fierro, Y. Hur, G. Grudic, V. Kumar, I. Lee, J. P. Ostrowski, G. J. Pappas, J. Southall, J. Spletzer, and C. Taylor “A framework and architecture for multi-robot coordination.”, *International Journal of Robotics Research*, Vol. 21, No.10-11, p. 977-995, Oct-Nov. 2002

Peer Reviewed Chapters in Books:

- B5. J. Kim, **J.M. Esposito**, and V. Kumar, “An RRT-Based Algorithm for Testing and Validating Multi-Robot Controllers”, *Robotics: Science and Systems*, (electronic journal) June 2005
<http://www.roboticsproceedings.org/rss01/index.html>

- B4.** **J.M. Esposito**, J. Kim and V. Kumar, “Adaptive RRT’s for validating hybrid robotic control systems”, *Workshop on the Algorithmic Foundations of Robotics: Springer Tracts in Advanced Robotics*, v 17, p 107-122, 2004
- B3.** R. Alur, A. Das, **J.M. Esposito**, R. Fierro, Y. Hur, G. Grudic, V. Kumar, I. Lee, J. P. Ostrowski, G. Pappas, J. Southall, J. Spletzer, and C. Taylor, “A framework and architecture for multi-robot coordination,” *Experimental Robotics VII,: Lecture Notes in Computer and Information Sciences*, Springer, 2001, Volume 271, p 303-312
- B2.** R. Alur, T. Dang, **J.M. Esposito**, R. Fierro, Y. Hur, F. Ivancic, V. Kumar, I. Lee, P. Mishra, G. J. Pappas, and O. Sokolsky, “Hierarchical hybrid modeling of embedded systems.”, in *Embedded Software, Lecture Notes in Computer Science*, vol. 2211, Springer-Verlag, October 2001, p 14-31
- B1.** **J.M. Esposito**, G. Pappas, and V. Kumar, “Accurate event detection for hybrid systems”, in *Hybrid Systems: Computation and Control (HSCC2001), Lecture Notes in Computer Science*, volume 2034, Springer, March 2001 p. 204-217

Peer Reviewed Conference Proceedings:

- C17.** C. McCook, **J.M. Esposito**, “Flocking for Heterogeneous Robot Swarms: A Military Convoy Scenario”, IEEE Southeastern Symposium on Systems Theory, March 2007, P. 26-31
- C16.** E.T. Smith, M.G. Feemster, and **J.M. Esposito**, “Swarm Manipulation of an Unactuated Surface Vessel”, IEEE Southeastern Symposium on Systems Theory, March 2007, P. 16-20
- C15.** **J.M. Esposito** and T.W. Dunbar, “Wireless constraints in swarm motion planning”, IEEE International Conference on Robotics and Automation, May 2006, p. 946-952
- C14.** M.G. Feemster, **J.M. Esposito** and J. Nicholson, “Manipulation of large objects by swarms of autonomous marine vehicles: Part I -- Rotation”, Proceedings of the *IEEE Southeastern Symposium on Systems Theory*, p255-259,March 2006
- C13.** **J.M. Esposito**, S. Avramov, R. DeMoyer and S. Parikh, “Promoting and assessing intuitive understanding in a junior-level modeling course”, Proceedings of the *America Society of Engineering Education*, June 2005
- C12.** T.W. Dunbar, and **J.M. Esposito**, “Artificial potential field controllers for robust communications in a network of swarm robots”, Proceedings of the *37th IEEE Southeastern Symposium on Systems Theory*, p 401-205, March 2005

- C11.** J. Kim, and **J.M. Esposito**, “Adaptive sample bias for rapidly-exploring random trees with applications to test generation”, Proceedings of the *IEEE Co-sponsored American Control Conference*, p 1166-1172, v. 2, June 2005
- C10.** **J.M. Esposito**, M.G. Feemster, and J.M. Watkins, “Role of a Matlab real-time hardware interface within a systems modeling course”, Proceedings of the *America Society of Engineering Education*, June 2004
- C9.** **J.M. Esposito**, “Randomized test case generation for hybrid systems: metric selection”, Proceedings of the *IEEE Southeastern Symposium on Systems Theory*, p. 236-240, March 2004
- C8.** **J.M. Esposito**, “Automated test trajectories for hybrid systems”, Proceedings of the *IEEE Southeastern Symposium on Systems Theory*, p.441-444 , March 2003
- C7.** **J.M. Esposito** and V. Kumar, “A tutorial on mobile robot programming, using a Hybrid Systems framework”, an invited paper for the Robot Programming Workshop, *IEEE Intl. Conf. On Robotics and Automation* (ICRA 2002), Washington, DC, May 2002
- C6.** **J.M. Esposito** and V. Kumar, “A method for modifying closed-loop motion plans to satisfy unpredictable dynamic constraints at runtime”, in *IEEE Intl. Conf. On Robotics and Automation*, p1691-1696, v 2, May 2002.
Finalist for the Best Paper Award
- C5.** **J.M. Esposito**, G. Pappas, and V. Kumar, “Multi-agent hybrid system simulation” Proceedings of the *IEEE Conference on Decision and Control*, p78-785, v.1, Dec 2001
- C4.** **J.M. Esposito** and V. Kumar, “Efficient dynamic simulation of robotic systems with hierarchy”, in *IEEE Int. Conf. Robotics and Automation*, , p. 2818-2823, v.3, May 2001
- C3.** K. A. McIsaac, A. K. Das, **J.M. Esposito**, and James P. Ostrowski, “A hierarchical, modal approach to hybrid systems control of autonomous robots”, Proceedings of *IEEE/RSJ Intl. Conf. On Intelligent Robots and Systems*, p1020-1025, v.2, November 2000
- C2.** **J.M. Esposito** and V. Kumar, “Closed loop motion plans for mobile robots”, Proceedings of the *IEEE Intl. Conf. On Robotics and Automation*, p2777-2782, v 3, May 2000
- C1.** R. Alur, **J.M. Esposito**, M. Kim, V. Kumar, and I. Lee, “Formal modeling and analysis of hybrid systems: A case study in multi-robot coordination”, *FM'99: Proceedings of the World Congress on Formal Methods*, LNCS 1708 Springer,

1999, p.212-232.

Invited Presentations:

- P7. **J.M. Esposito**, “Autonomous Tugboat Swarms”, Workshop on Swarming in Natural and Engineered Systems, Philadelphia, PA, May 2007
- P6. **J.M. Esposito**, “Swarm manipulation with Tugboats”, University of Florida Robotics Lab Seminar Series, February 2007
- P5. **J.M. Esposito**, “Grasp Optimization for swarms”, Workshop on Cooperative Control and Optimization, Gainesville, FL, February 2007
- P4. **J.M. Esposito**, “New directions in testing hybrid control systems”, Workshop on Randomized Methods in Control and Planning, Philadelphia, PA, March 2004
- P3. **J.M. Esposito**, “Randomized approaches to testing complex control systems”, Weapons and Systems Engineering Department, Seminar Series, USNA, Fall 2003
- P2. **J.M. Esposito**, “A tutorial on mobile robot programming, using a Hybrid Systems framework”, IEEE Robot Programming Workshop, Washington, DC, May 2002
- P1. **J.M. Esposito**, “Numerical techniques for simulating sets of discontinuous differential equations”, Mechanical Engineering Seminar Series, University of Pennsylvania, 2001

Funded Research:

- G2. **Principal Investigator: J.M. Esposito**, Title: “Distributed manipulation of large objects on the water by swarms of autonomous surface vessel”, Amount: \$180,000, Source: competitive *Office of Naval Research* Grant N0001405WR20391, Date: FY2005- 2007
- G1. **Principal Investigator: J. M. Esposito**, Title: “Automated Test Generation for Embedded Control Systems”, Amount: approx \$40,000, Source: *Naval Academy Research Council*, Date: FY2003- 2004

Awards:

- A9. *Finalist for Best Conference Paper Award*, IEEE International Conference on Robotics and Automation, May 2002, selected as one of three finalists (out of 689 papers) for the best conference paper award
- A8. *NSF Summer Engineering Education Workshop*, Durham, NH July 2002: Selected as a graduate student to attend workshop for future faculty members regarding course development, and teaching styles
- A7. *John Golf Prize*, May 2001: Awarded biannually to the graduate student showing the most promise for future scholarship and leadership in the Department of Mechanical Engineering at the University of Pennsylvania

- A6.** *NSF Travel Grant*, April 2001: Travel to Seoul, South Korea
- A5.** *NSF GAAN Fellowship*, September 1997 – September 2001: Stipend support
- A4.** *Trask Ashton Fellowship*, September 1997 – September 2001: University of Pennsylvania full tuition award
- A3.** *Toomey Engineering Scholarship*, September 1997: Awarded to an outstanding senior engineering student at Rutgers University
- A2.** *Robert C. Byrd Scholar*, July 1993-May 1997: Awarded to college undergraduates demonstrating high academic achievement
- A1.** *Edward Bloustein Scholar*, September 1993 – May 1997: Awarded to most promising college bound high school seniors in the state of New Jersey

5. SERVICE

a. United States Naval Academy:

Plebe Adviser, 19th Company, AY 2003-Present
Faculty Representative, USNA Mountaineering Club, AY 2003-2005
Volunteer Judge, FIRST Robotics, AY 2006

b. Engineering and Weapons Division:

Instructor, EX281 Introduction to Engineering, Instructor, AY 2006 (team taught; not credited under teaching load)

c. Weapons and Systems Engineering Department:

ES405 Design, Committee Member, AY2006

- Revised topic sequence
- Selected text
- Produced guidance paper for laboratory portion of course

Autonomous Vehicles Exploratory Committee, AY 2005

- Evaluated feasibility of new course offering
- Drafted syllabus, course description, prerequisites, and text selection
- Laboratory outline

Hiring Committee Member, AY2004, 2006

- Advertised for faculty candidates
- Reviewed applications according to ranking methodology
- Set up interview logistics for faculty candidates

Department Coordinator of Midshipman Research, AY 2004-present

- Organized practice sessions for Trident Applicants
- Administered application, registration, and requirement compliance for ES495/496 Independent Research Project Courses; and acted as a liaison to USNA Deputy Director

- of Undergraduate Research
- Boosted program visibility by instituting poster session, new recruitment and advertising methods

Honors Committee Member AY2004

- Drafted structure of systems engineering honors program
- Drafted syllabus of ES 307 Honors

ES301 Redesign, Committee Member AY2004

- Drafted new syllabus to place more emphasis on standard modeling techniques and first principles philosophy
- Selected new text book

Systems Outreach Committee, AY2003-Present

- Assisted with Plebe Majors brief.
- Assisted with Majors night
- Systems ball organizational committee and referee
- Production of promotional videos

Academic Advisor, AY2003-Present

- Academic advisor for 8-15 System Engineering Majors per semester

Department Curriculum Committee Member AY2003- present

d. Professional Community:

Organizer Invited Session, “Cooperative Manipulation by Swarms of mobile Robots”, IEEE Intl. Conference on Robotics and Automation 2007

Associate Editor, International Conference on Intelligent Robots and Systems (IROS) 2007

Grant Review Panel Member, Office of Naval Research

Session Chair, IEEE Intl. Conference on Robotics and Automation

Session Chair, American Society of Engineering Education

Peer Reviewer, IEEE Conference on Decision and Control,

Peer Reviewer, American Control Conference

Peer Reviewer, American Society of Engineering Education

Peer Reviewer, IEEE Southeastern Symposium on System Theory