Nicholas M Limparis

Curriculum Vitae

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Research Interests

Robotic Kinematics, Dynamics of Robotic Manipulators, Orbital Debris Mitigation, Small-Sat Based Satellite Servicing, Planetary Exploration

Education

University of Maryland, College Park, Maryland USA

Ph.D., Aerospace Engineering, May 2024

- Dissertation Topic: "Inertial Parameter Identification of a Captured Payload Attached to a Robotic Manipulator on a Free-Flying Spacecraft"
- Advisor: Dr. David L. Akin, University of Maryland

M.S., Aerospace Engineering, Dec 2012

B.S., Electrical Engineering, Honors May 2008

Montgomery College, Rockville, Maryland USA

A.S., Electrical Engineering, Summa Cum Laude, Montgomery Scholars May, 2006

Honors and Awards

Montgomery College: Honors in Engineering, Montgomery Scholars Honors Program, Phi Theta Kappa, Summa Cum Laude 2006
University of Maryland: Eta Kappa Nu, Electrical Engineering Honors. 2008
Space and Satellite Professionals International (SSPI) Fellow Clark Doctoral Fellow

Academic Experience

University of Maryland, College Park, Maryland USA

Coinstructor-Of-Record **Aug, 2024 - Dec, 2024**

ENAE483: Principles of Space Systems Design
ENAE788X: Selected Topics in Aerospace Engineering; Planetary Surface Robotics

Postdoctoral Researcher **June, 2024 - Present**

University of Maryland, Planetary Surfaces and Spacecraft Lab

Graduate Research Assistant **August, 2008 - May 2024**

Included Ph.D. research, Ph.D. and Masters level coursework research/consulting projects.

Teaching Assistant **January, 2012 —July, 2016**

Co-taught senior level course for the Aerospace Engineering Department for a Design, Build, Compete. Shared responsibility for lectures, exams, homework assignments, and grades.

- ENAE488R , Spring and Summer 2012-2016

Teaching Assistant **September, 2022 - June, 2023**

Teaching Assistant for senior level Capstone course for the Aerospace Engineering Department students on the Space Track. Shared responsibility for lectures, exams, homework assignments, and grades.

- ENAE483, Fall 2022
- ENAE484, Spring 2023

Publications

[15] N. M. Limparis, "Inertial parameter identification of a captured payload attached to a robotic manipulator on a free-flying spacecraft," Ph.D. dissertation, University of Maryland, May 10, 2024, 174 pp. DOI: 10.13016/ol3v-o4zv. [Online]. Available: https://ssl.umd.edu/node/149.

[14] C. Hanner, N. Bolatto, D. L. Akin, and N. Limparis, "Earth-analogue roving system development and testing for lunar surface exploration," in *ASCEND 2023*, American Institute of Aeronautics and Astronautics, Oct. 2023. DOI: 10.2514/6.2023-4638.

[13] N. Bolatto, C. Hanner, N. M. Limparis, and D. L. Akin, "Small dexterous space manipulators: Technology development and mission applications," in *ASCEND 2022*, American Institute of Aeronautics and Astronautics, Oct. 2022. DOI: 10.2514/6.2022-4364.

[12] K. M. McBryan, N. M. Limparis, C. J. Carlsen, and D. L. Akin, "RANGER: Upgrading dexterous space teleoperator capabilities by incorporating commercial off-the-shelf components," in *AIAA SPACE and Astronautics Forum and Exposition*, American Institute of Aeronautics and Astronautics, Sep. 2017, p. 5310. DOI: 10.2514/6.2017-5310.

[11] D. L. Akin, K. McBryan, N. Limparis, and N. D'Amore, "Economies of (small) scale: Exploring the potential for smallsat-based dexterous robotics," in *AIAA SPACE 2014 Conference and Exposition*, American Institute of Aeronautics and Astronautics, Aug. 2014, p. 4339. DOI: 10.2514/6.2014-4339.

[10] D. L. Akin, K. McBryan, N. Limparis, N. D'Amore, and C. Carlsen, "Habitat design and assessment at varying gravity levels," in *44th International Conference on Environmental Systems*, Jul. 17, 2014.

[9] D. L. Akin, K. M. McBryan, N. M. Limparis, C. J. Carlsen, and K. P. Davis, "Miniature orbital dexterous servicing system," in *Proceedings of 12th International Symposium on Artificial Intelligence, Robotics and Automation in Space (i-SAIRAS 2014),(Montreal, Canada)*, Montreal, Canada, Jun. 1, 2014. eprint: https://robotics.estec.esa.int//i-SAIRAS/isairas2014/Data/Session%205b/ISAIRAS_FinalPaper_0123.pdf. [Online]. Available: https://robotics.estec.esa.int//i-SAIRAS/isairas2014/i-SAIRAS%202014%20Proceedings.html#Session5b.

[8] C. Carlsen, K. McBryan, N. Limparis, and D. L. Akin, "Neutral buoyancy testing of workstations for space station utilization," in *65th International Astronautical Congress*, International Astronautical Federation (IAF), vol. IAC-14,A5,3-B3.6,5,x24350, Oct. 2014. [Online]. Available: https://iafastro.directory/iac/archive/browse/IAC-14/A5/3-B3.6/24350/.

[7] N. Limparis, K. McBryan, C. Carlsen, and D. L. Akin, "Micro-sat based dexterous robotic satellite servicing: A case for miniaturization," in *65th International Astronautical Congress*, International Astronautical Federation (IAF), Oct. 2014. [Online]. Available: https://iafastro.directory/iac/archive/browse/IAC-14/B4/6A/22780/.

[6] D. L. Akin, K. McBryan, and N. Limparis, "Dymaflex: Dynamic manipulation flight experiment," MARYLAND UNIV COLLEGE PARK, Tech. Rep., Sep. 3, 2013. [Online]. Available: https://apps.dtic.mil/sti/pdfs/ADA589986.pdf (visited on 10/24/2023).

[5] D. Akin, N. Limparis, and K. McBryan, "Enabling dexterous manipulation and servicing by smallsats," *26th Annual AIAA/USU Conference on Small Satellites*, 2012. eprint: https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1053&context=smallsat. [Online]. Available: https://digitalcommons.usu.edu/smallsat/2012/all2012/47/ (visited on 10/24/2023).

[4] N. M. Limparis and D. L. Akin, "Design of a distributed control architecture for the SAMURAI deep submergence manipulator," in *2012 IEEE/OES Autonomous Underwater Vehicles (AUV)*, IEEE, Southampton, UK: IEEE, Sep. 2012, pp. 1–8. DOI: 10.1109/auv.2012.6380729.

[3] C. Carlsen, J. Galante, P. Goldin, *et al.*, "Tortuga vi robotics@ maryland," *AUVSI Robosub 2010*, 2010.

[2] T. Capon, J. Lisee, S. Moschevko, and N. Limparis, "Tortuga ii autonomous underwater vehicle," *AUVSI Robosub*, 2008.

[1] C. Lewandowski, D. Akin, B. Dillow, *et al.*, "Development of a deep-sea robotic manipulator for autonomous sampling and retrieval," in *2008 IEEE/OES Autonomous Underwater Vehicles*, IEEE, Woods Hole, MA, USA: IEEE, Oct. 2008, pp. 1–6. DOI: 10.1109/auv.2008.5290533.

Papers in preparation

- Limparis, Nicholas M., "Extending the Inverse Direct Dynamic Model for space free-flyer applications".
- Limparis, Nicholas M., "Experimental results and analysis of the novel Extended Inverse Direct Dynamic Model"

Conference Presentations

- International Astronomical Congress 2014; Toronto, Canada
- IEEE OES 2012; South Hampton, UK

Professional Experience

University of Maryland, Planetary Surfaces and Spacecraft Lab, 3179 Glenn L Martin Hall
University of Maryland
College Park, MD 20742 USA

Postdoctoral Researcher **June 2024 - Present**

Duties, Accomplishments and Related Skills:
NASA LuSTER Bio-Inspired Dust Removal Contract

- Design and sourcing of an Ultra High Vacuum (UHV) test chamber for gecko inspired dust removal
- Design, testing and automation of a robotic platform to load a gecko skin adhesive in UHV
- Design, testing of a kinetic spinning based dust removal apparatus to unload the dust from gecko skin
  - Guide a team of undergraduate research experience students through the theory, design, and construction of the kinetic spinner test apparatus

Supervisor: Dr. Christine Hartzell (hartzell@umd.edu)
Okay to contact this Supervisor: Yes

University of Maryland, Space Systems Lab, 382 Technology Drive,
University of Maryland
College Park, MD 20742 USA

Graduate Research Assistant **August 2008 - May 2024**

Duties, Accomplishments and Related Skills:
Lead Electronics design for the RANGER tele-robotics refresh contract from NASA Goddard NExIS (CODE 480)

- Lead a team for the refresh of obsoleted motion control electronics for a serial robotic manipulator system
- Design and test of a position feedback system for absolute positioning of the robotic manipulator
- Responsible as part of a team for systems engineering, including interface control documents and system risk analysis
- Engineer responsible for wiring harness design for internal systems as well as ground support equipment
- Use machine tools for the manufacture of small components for the ground support equipment

Project manager for the Air Force Research Lab NS-7 DYMAFLEX program

- Directed a team of undergraduate and graduate students through the design and testing of a free-flying small satellite with a high performance robotic manipulator to be used as a dynamics demonstrator for small-sat based satellite servicing missions
- Helped with the design and implementation of a documentation management system to maintain consistency within documents and have a formalized strategy for the addition of documents for a flight system
- Lead designer for electronic systems on the vehicle, directly designed the power systems and command and data handling system

Project manager for the NASA/DARPA ExoSPHERES program

- Directed a team of undergraduate and graduate students through the design and testing of an engineering unit for a free-flying small satellite designed to provide a multipurpose inspection and astronaut assistance vehicle around the International Space Station while still having operational capabilities within station
- Designed, built, and tested the electronics for both the engineering design unit and the Neutral Buoyancy demonstrator version, EUCLID

Electronics design for NSF grant OCE0752347 for the SAMURAI deep submergence robotic manipulator

- Designed, built and tested an system of electronics for the deep sea electric manipulator SAMURAI for the collection of biological samples from the deep ocean (6 km depth)
- Integrated motion control units onto a Firewire bus to provide real time control and allow for the transmission of video data on the same bus as control

NASA AFO-6 Parabolic Flight Recipient: DyMaFlEx

- Wrote proposal with another graduate student for flight opportunity to experimentally verify the proposed dynamics of Dubowsky and Papadopoulos's "The Kinematics, Dynamics, and Control of Free- Flying and Free-Floating Space Robotic Systems" using the DyMaFlEx system developed for the AFRL NS-7 project cycle
- Worked with engineers from NASA on the flight readiness of the free-flying robotic system
- Flew on the parabolic mission and helped with post-processing of the acquired data. In the process of writing a journal paper with the experimental results

Information Technology: System Administrator for Space Systems Lab
- Maintained and upgraded the IT infrastructure used by the laboratory to provide sever side resources for the users within the laboratory
- Maintained and upgraded laboratory website resources including but not limited to public and internal websites, wikis, and archival data storage
- Designed layout and implementation of software and hardware design version control systems for both open and closed source designs within the laboratory

NASA RASC-AL robo-ops program
- Helped to mentor a team of undergraduate students through the design and testing of a tele-operated rover that is capable of remotely surveying, driving and collecting rock samples over a bandwidth limited data connection at the NASA JSC rock yard
- Help to lead the team to a victory in 2015 where the team set a new course record and won the competition

Scientific Diver
- Administer and maintain diving equipment and records of repairs and maintenance for the Neutral Buoyancy Research Facility
- Lead diver with significant experience inside and outside the closed water environment of the lab
- Certified AAUS Scientific Diver

Mentor to Undergraduate students
- Mentor honors undergraduate students in senior honors design projects where they are tasked with designing and building a hardware system of their choosing relating to the field of space systems
- Participate in the design review process as a reviewer for the undergraduate senior level capstone design course

Mentor to Undergraduate Research Assistants
- Onboard new undergraduate research assistants for the laboratory
- Mentored approximately two dozen long term undergraduate research assistants
- Mentored many more, shorter term undergraduate assistants
- Many of the long term students went on to graduate school for advanced degrees

Supervisor: Dr. David L. Akin (3014051138) dakin@umd.edu
Okay to contact this Supervisor: Yes

Computer Skills

- Languages: C/C++, Python 3, Unix shell scripts, Matlab, Octave, Mathematica, VHDL, Verilog, HTML, Jupyter, Assembly, Markdown
- Applications: LaTeX, spreadsheets, presentation software, Visio, Microsoft Project, GraphViz, WireViz, Labview, GIMP, SLURM,
- Algorithms: Experience programming Monte Carlo simulations, numerical methods
- Operating Systems: DOS, Unix/Linux, Windows, OS X, FreeRTOS, QNX