DAVID BOMBARA

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EDUCATION

University of Nevada, Reno *August 2020–May 2022 (Expected)*
Master of Science in Mechanical Engineering Cumulative GPA: 4.000/4.000

Relevant Courses: *Linear Systems* (A), *Control Systems II* (A), *Machine Intelligence* (A), *Nonlinear Control Systems* (A), *Digital Control Engineering* (A), *Adaptive Control* (in progress).

University of Nevada, Reno *July 2016–May 2020*
Bachelor of Science in Mechanical Engineering Cumulative GPA: 3.834/4.000
Honors Program graduate; Dean's List recipient for seven semesters.

Relevant Courses: *Introduction to Robotics* (A), *Introduction to System Control* (A).

RESEARCH EXPERIENCE

Smart Robotics Laboratory, University of Nevada, Reno August 2020–August 2022
Graduate Research Assistant, Department of Mechanical Engineering *Reno, NV*

· Developed an algorithm to achieve desired performance metrics in twisted string actuators (TSAs) by inverting the physics-based TSAs models and sorting a database containing commercially available components.
· Conducted the experimental characterization and data-driven modeling of self-sensing compliant TSAs.
· Conducted design, characterization, modeling, and open-loop control of a soft robotic manipulator driven by TSAs.
· Investigated a strategy to significantly increase strain of TSAs; implemented strategy in a custom robotic bicep.
· Mentored a participant in the NSF Research Experience for Undergraduates (REU) 2021 BioSoRo site.

NASA Langley Research Center June 2020–May 2021
Intern, Advanced Measurements and Data Systems Branch *Hampton, VA (Virtual)*

· Surveyed literature on the qualification and testing of materials in low-earth orbit (LEO), including *in situ* evaluation missions and simulated LEO environments.
· Developed a system for automated real-time characterization of phase-change tunable filters using a linear variable filter and infrared camera for wide-field mid-wave infrared imaging.
· Developed a graphical user interface to control a laser and acquire data from optical instruments via the MATLAB App Designer, Instrument Control toolbox, and Raspberry Pi support package.

Smart Robotics Laboratory, University of Nevada, Reno November 2018–June 2020
Undergraduate Research Assistant, Department of Mechanical Engineering *Reno, NV*

· Conducted the design, characterization, and quasi-static modeling of TSAs capable of strain self-sensing.
· Designed and 3D-printed a robotic gripper with compliant TSAs and Fin Ray Effect-inspired compliant fingers.
· Key personnel on design and experimental testing of high-performance and self-sensing TSAs.
· Conducted design and preliminary testing of dielectric elastomer actuators to generate finger-like bending motions.
· Spoke to local K–12 and community college students about the lab's robotics research.

NASA Ames Research Center June–August 2019
Intern, Rotorcraft Aeromechanics Branch *Mountain View, CA*

· Prototyped a circuit containing sound, ultrasonic distance, temperature, and gas sensors to be mounted on a mobile robot with applications in autonomous indoor urban search and rescue.
· Developed Bluetooth communication system for live data stream between robot and base station.
· Surveyed literature on terrestrial and aerial robots for urban search and rescue applications.

INDUSTRY EXPERIENCE

Western States Fire Protection   May–August 2018
Design Intern   *Las Vegas, NV*

· Routed virtual standpipe and sprinkler pipe routes using building information modeling (BIM) software for future 400,000 ft^2 Wynn convention center; designed fire sprinkler and pipe layout for three- and four-story residences.

Nevada Department of Transportation   May–August 2017
Public Service Intern, Construction Division   *Las Vegas, NV*

· Conducted laboratory experiments on construction aggregate for Nevada's largest-ever public works project.

SERVICE

College of Engineering, University of Nevada, Reno   August 2021–Present
Outreach Student Worker   *Reno, NV*

· Drove 300 miles to Elko, NV to speak to prospective students about UNR's engineering programs.
· Spoke to prospective students at UNR's *Nevada Bound* events, where students would fly from Las Vegas, NV to Reno, NV and learn about undergraduate engineering programs.
· Facilitated engineering lessons for middle school students through the College of Engineering's EPIC (Engineering Program Inspiring the Community) Lab.

AWARDS AND HONORS

NASA Space Technology Graduate Research Opportunities (NSTGRO) Fellowship   August 2021
NASA Space Technology Mission Directorate

· Funding for the proposal, "Design, Fabrication, and Control of a Robotic Gripper Powered by Compliant and Self-Sensing Twisted String Actuators."

Graduate Research Opportunity Fellowship   May 2021
Nevada NASA Space Grant Consortium

· Declined due to also receiving the NSTGRO fellowship.

Travel Award   July 2021
Graduate Student Association, University of Nevada, Reno

· Award to fund my attendance to the *2021 Modeling, Estimation, and Control Conference* (MECC), where I presented a co-first-authored paper of mine.

Exceptional Contribution Award   August 2020
Advanced Measurements and Data Systems Branch of NASA Langley Research Center

· "In recognition of your dedication and significant technical contributions towards the development of a reliability test for an actively tunable mid-wave infrared optical filter."

2020-2021 Graduate Dean's Merit Scholarship   March 2020
The Graduate School, University of Nevada, Reno

· Awarded to "an elite selection of master's and doctoral students who show the potential to make substantive contributions to their discipline".

Nevada Undergraduate Research Travel Award   July 2019
Office of Undergraduate Research, University of Nevada, Reno

· For travel to the *2019 ASME Conference on Smart Materials, Adaptive Structures, and Intelligent Systems*.

2019-2020 Undergraduate Scholarship   June 2019
Nevada NASA Space Grant Consortium

· For the proposal: "Development of an Artificial Muscle-Powered Robotic Grasper for NASA Rovers".

Nevada Undergraduate Research Award   December 2018
Office of Undergraduate Research, University of Nevada, Reno

· For the proposal: "Development of a Muscle-Powered Humanoid Robot Hand with Optimal Performance".

TECHNICAL STRENGTHS

Circuit Prototyping: Microcontrollers, C/C++, breadboarding, circuit simulators, and soldering.
Data Acquisition and Analysis: MATLAB, SIMULINK, LabVIEW, National Instruments devices, and Arduino.
Mechanical Design: SolidWorks, Fusion 360, AutoCAD, and 3D printers.
Lab Equipment: Power supplies, oscilloscopes, signal generators, and high voltage amplifiers.

JOURNAL PUBLICATIONS

[J5] **D. Bombara***, R. Konda*, E. Chow, R. Coulter, and J. Zhang, "A twisted string actuator-powered soft robotic manipulator: design, characterization, modeling, and open-loop control," in *IEEE Transactions on Robotics*. Under review.

[J4] **D. Bombara***, R. Konda*, and J. Zhang, "Overtwisting and coiling highly enhances strain generation of twisted string actuators," in *Soft Robotics*. Under review.

[J3] **D. Bombara**, C. Williams, S. E. Borg, and H. J. Kim, "Automated real-time spectral characterization of phase-change tunable filters using a linear variable filter and IR camera for wide-field MWIR imaging," in *Optical Engineering*, vol. 60, no. 8, p. 084105, Aug. 2021, doi: 10.1117/1.OE.60.8.084105.

[J2] **D. Bombara**, R. Konda and J. Zhang, "Experimental characterization and modeling of the self-sensing property in compliant twisted string actuators," in *IEEE Robotics and Automation Letters*, vol. 6, no. 2, pp. 974-981, April 2021, doi: 10.1109/LRA.2021.3056372.

[J1] **D. Bombara**, S. Fowzer, and J. Zhang, "Compliant, large-strain, and self-sensing twisted string actuators," in *Soft Robotics*. Ahead of Print, doi: 10.1089/soro.2020.0086.

CONFERENCE PROCEEDINGS AND PRESENTATIONS

[C9] H. J. Kim, S. Borg, W. Humphreys, M. Julian, C. Williams, **D. Bombara**, Y. Zhang, J. Hu, and T. Gu, "Phase-change-material (PCM)-based actively tunable filters for both terrestrial and spaceborne platforms" in *High Contrast Metastructures XI, International Society for Optics and Photonics*, to appear.

[C8] T. Tsabedze, **D. Bombara**, R. Konda, and J. Zhang, "A comparative study between twisted string actuators and spooled-motor tendon-driven actuators," in *2022 American Control Conference*, Atlanta, GA, submitted.

[C7] **D. Bombara**, R. Konda, Z. Kibria, and J. Zhang, "Inverse modeling for component selection of twisted string actuators," in *2022 39th IEEE International Conference on Robotics and Automation*, Philadelphia, PA, submitted.

[C6] **D. Bombara***, R. Konda*, E. Chow, and J. Zhang, "Physics-based kinematic modeling of a twisted string actuator-driven soft robotic manipulator," in *2022 American Control Conference*, Atlanta, GA, submitted.

[C5] **D. Bombara***, R. Konda*, and J. Zhang, "Overtwisting and coiling of twisted string actuators for large strain generation" in *2022 39th IEEE International Conference on Robotics and Automation (ICRA)*, Philadelphia, PA, submitted.

[C4] **D. Bombara***, R. Coulter*, R. Konda*, and J. Zhang, "A twisted string actuator-driven soft robotic manipulator," in *the 2021 Modeling, Estimation, and Controls Conference*, Austin, TX, USA, 2021, to appear.

[C3] H. J. Kim, M. Julian, C. Williams, S. Borg, **D. Bombara**, and W. Humphreys, "Active tunable MWIR filters: phase-change tunable filters for MWIR imaging based on GeSbTe-integrated metasurfaces," in *2021 SPIE Image Sensing Technologies: Materials, Devices, Systems, and Applications VIII*, 2021 vol. 11723, p. 1172304.

[C2] J. Zhang, **D. Bombara**, S. Fowzer and C. Brennan, "Compliant and large-strain twisted string actuators using supercoiled polymers," in *2020 3rd IEEE International Conference on Soft Robotics (RoboSoft)*, New Haven, CT, USA, 2020, pp. 201-207.

[C1] **D. Bombara**, V. Mansurov, R. Konda, S. Fowzer, and J. Zhang, "Self-sensing for twisted string actuators using conductive supercoiled polymers," in *Proc. ASME Conf. Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS)*, Paper SMASIS2019-5587, 2019.

* These authors contributed equally to the manuscript and are considered co-first authors.