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To Whom It May Concern:

I am writing to express my interest in the two technical positions in the autonomous underwater vehicle (AUV) group at the Monterey Bay Aquarium Research Institute (MBARI). I am a recent PhD of Mechanical and Aerospace Engineering from the College of Science & Engineering at Syracuse University, worked in Autonomous Unmanned System Lab (AUSLab) at Syracuse Center of Excellence under the direction of Dr. Sanyal. My PhD research focus was on developing theories on discrete-time stable geometric controllers and observers for autonomous unmanned systems. My research interests cover several topics in nonlinear systems theory, machine learning, robotics, dynamics, guidance & navigation, and control of unmanned aerial vehicles that can be modeled as rigid body and multi-body systems. I would like to join your research team at MBARI, as I am confident that this position would provide me with skills and experiences I need to advance my career to the next level. In the same way, I would have an opportunity to present my enthusiasm and all my abilities, and skills in design and development of autonomous systems, and to add my insight and work ethic to your research team.

Throughout my education in the PhD program, I have had many responsibilities and achievements that would serve me well as an engineer at your team in MBARI focusing on design and development of Control, Robotics and Autonomous Systems. As you can see from my CV, my general interests are in control theory, robotics, and dynamical systems. I have been a research and teaching assistant since May 2016 in Dr. Sanyal's research group, where I dedicated myself to developing geometric control theories and algorithms for trajectory generation, nonlinear state estimation, and nonlinear tracking control for autonomous systems, particularly Unmanned Aerial Vehicles (UAVs) along with conducting experiments to verify the developed theories. A short list of aforementioned research I have conducted is as following:

- Designed discrete-time stable pose tracking control schemes with asymptotic and finite-time stability for underactuated robotic systems.
- Developed a finite-time stable attitude and angular velocity bias estimation for rigid bodies with unknown dynamics.
- Designed a trajectory generation scheme on $SE(3)$ as an optimal Linear Quadratic Regulator (LQR) problem in the exponential coordinates with applications to a class of underactuated vehicles.
- Designed a trajectory generation and tracking control scheme on $SE(3)$ for an underactuated vehicle with pointing direction constraints.
- Developed an optimal trajectory generation scheme on $SE(3)$ as a discrete-time LQR problem in order to pass through multiple waypoints.
- Conducted research and experiments in a collaborative project on enabling multimodal sensing, real-time onboard detection and adaptive control for fully autonomous UAVs¹.

Although much of my past research has focused on dynamics and control of aerospace systems, I would feel comfortable working on a wide class of problems related to dynamical systems and their control. In addition to my academic achievements, I spent more than 3 years as a Robotics research intern at Akrobotix LLC in Syracuse Technology Garden, where I had the opportunity to become involved in different projects and learn to have a practical hands-on approach to complement the theoretical knowledge and creativity in hardware/software integration and implementation.

¹ <http://hydrogen.syr.edu/~AutonomousUAVs/>

Throughout this internship, I participated in the development of autonomous aerial vehicles and gained experiences in the following:

- Building different UAV platforms from scratch with different flight controllers and MCUs such as Pixhawk, Arduino, etc. along with companion computers modules, as well as various sensors such as IMU, GPS, Vicon Cameras, Lidar, Sonar, etc.
- Experience in embedded system and edge-computing modules, such as Jetson TX series, Intel NUC, Raspberry Pi, and Arduino.
- Implementation of developed algorithms in software, unit level, and system-level testing using both simulation and real systems in the loop.
- Hands-on experience in system integration and robotics research experience in platform mechanics, and unmanned vehicle navigation and guidance in outdoor and GPS-denied environment.
- Integration of software with sensors, actuators, and all hardware components using ROS (Robotic Operating System).
- Developing appropriate user interfaces, test procedures, requirements documentation and verification as needed.

I have obtained research results on a wide class of advanced dynamics and control problems, which are listed in my CV. It includes a list of published peer-reviewed conference and journal papers such as CDC, ACC, and ECC conference papers as well as a published paper in International Journal of Control. I have also an under-review paper submitted in Automatica journal and they are all provided in my CV that document my research accomplishments to date. I was also awarded with the Research Excellence Doctoral Funding (REDF) Fellowship by Syracuse University graduate school for 2019-20 academic year.

During my career as an Engineer in either of two technical positions available at MBARI, I would like to participate in teams of researchers focusing on design and development of innovative, and sophisticated autonomous algorithms of navigation, controls, and motion planning techniques for underwater autonomous vehicles, as well as operation, maintenance, and repair of such equipment, and supporting other research staff during the development and validating of prototype systems and methods both in simulation and on the vehicle platform. I would be also a very effective support in developing appropriate user interfaces, test procedures, and post-processing of results. I would bring both my theoretical and hands-on experimental experiences of algorithm development and hardware integration into my work and would collaborate closely with the research team to ensure high level performance goals are met and research objectives are achieved. In this way, I believe that I can add values to the research work in your team and make a contribution to the fast-growing world of underwater autonomy.

With my background in Dynamics, Control, and Robotics as well as my expertise with research on autonomous vehicles, and also my passion for team collaboration, I am strongly confident that I would be a great fit for either of these positions and I can contribute positively to the efforts of the research team at MBARI. I would welcome the opportunity to answer any questions you may have, and I look forward to speaking with you soon. I can be reached at (315) 385-1992 and rhamrah@syr.edu. Thank you for your time and consideration.

Sincerely,

Reza Hamrah