Arun Lakshmanan

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Education

PhD Mechanical Science and Engineering — **Jan 2017 - present**
University of Illinois at Urbana-Champaign, Urbana, IL.

M.S. Aerospace Engineering — **Aug 2014 - Dec 2016**
University of Illinois at Urbana-Champaign, Urbana, IL.

B.Tech. Mechanical Engineering — **July 2010 - May 2014**
VIT University, Vellore, India.

Selected Coursework

Optimal Aerospace Systems, Machine Learning for Signal Processing, Advanced Robotics Planning, Robust Adaptive Control, Nonlinear Systems, Introduction to Robotics, and Digital Control Systems.

Experience

Advanced Controls Research Laboratory, Urbana, IL. — **Aug 2014 - present**
Graduate Research Assistant

- Presently working towards designing motion planning methods which can compute optimal trajectories in cluttered spaces in a computationally efficient manner.
- Designed a computationally efficient trajectory generation approach using piecewise Bézier curves for differentially flat systems. This approach can be used to generate feasible minimum snap trajectories for quadrotors in the least time with the added advantage of using the convex hulls of Bézier curves to check for any collisions incurred during interpolation. Further analysis and results can be found in the master's thesis.
- Constantly involved with all software-related development in the research group. Implemented path following controllers on ground robots for precise tracking, designed line-of-sight based collision avoidance methods replying purely on directional sensor information, and more recently, geometric controllers were implemented to track aggressive trajectories on quadrotors.

Paracosm/Occipital, Gainesville, FL. — **May 2017 - Jul 2017**
Intern Engineer

- Developed a motion planning library and associated unit tests for applications to request collision free paths when provided with a occupancy map.

Qualcomm Research, Philadelphia, PA. — **May 2016 - Aug 2016**
Intern Engineer

- Involved with the firmware development of the Snapdragon Flight board for autonomous quadrotor applications using vision-based sensor information. Designed motion planning and obstacle avoidance algorithms for indoor navigation using vision-based sensors.

Technical Summary

I have extensive experience with robotics development on quadrotors and ground robots in the areas of controller architecture design, motion planning and trajectory optimization. I am very interested in computationally efficient solutions to trajectory generation for mobile robots in cluttered environments.

I am adept at writing **C/C++** software for embedded systems, **Python** for rapid prototyping and high-level decision making, **ROS** packages for communication services, and **Julia**, **MATLAB** and **Simulink** models for analysis and design. I have primarily developed software for ARM-based processors running Linux/FreeRTOS environments.

Programming Experience

- Languages: Julia (9/10), Python (9/10), C/C++(7-8/10), C# (7/10)
- OS/Middleware: Linux (9/10), ROS (8/10), FreeRTOS (7/10)
- Software: MATLAB/Simulink (9/10), Unity3D (7/10)
- Favorite Text Editor : Vim

Publications

- R. M. Jones, D. Sun, G. B. Haberfeld, **A. Lakshmanan**, T. Marinho, and N. Hovakimyan. Design and Control of a Small Aerial Manipulator for Indoor Environments. In *AIAA Guidance, Navigation, and Control Conference*, page 1374, Jan. 2017
- **A. Lakshmanan**. Piecewise Bézier Curve Trajectory Generation and Control for Quadrotors. Master's thesis, University of Illinois at Urbana-Champaign, Dec. 2016
- T. Marinho, C. Widdowson, A. Oetting, **A. Lakshmanan**, H. Cui, N. Hovakimyan, R. F. Wang, A. Kirlik, A. Laviers, and D. Stipanovic. Carebots: Prolonged Elderly Independence Using Small Mobile Robots. *Mechanical Engineering; New York*, 138(9):S8–S13, Sept. 2016b
- T. Marinho, **A. Lakshmanan**, V. Cichella, C. Widdowson, H. Cui, R. M. Jones, B. Sebastian, and C. Goudeseune. VR study of human-multicopter interaction in a residential setting. In *2016 IEEE Virtual Reality (VR)*, pages 331–331, Mar. 2016a
- R. Lele and **A. Lakshmanan**. Optimization of extreme-weather forecasting systems in developing nations. *Int. Res. J. Earth Sci.*, 3(4):27–35, Apr. 2015