Arun Lakshmanan

github.com/arunlakshmanan
arunlakshmanan.com

Objectives

I want to work with a community of researchers to put to use my skills in robotics and control systems and build creative solutions in the world of autonomous systems.

Education

PhD Aerospace 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.

Relevant Coursework

Advanced Robotics Planning, Robust Adaptive Control, Nonlinear & Adaptive Control, Nonlinear Systems, Real Variables, Control Systems Theory & Design, Introduction to Robotics, and Digital Control Systems.

Experience

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

- 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.
- Constructed a virtual reality environment with simulated quadrotor dynamics for a psychology study to characterize the perceived discomfort of humans in the vicinity of quadrotors. The parameters learned from this study was used to design a cost function to generate trajectories that minimize the perceived discomfort.

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 an obstacle avoidance controller for assistive collision prevention using noisy vision-based range information.
- Developed sampling-based motion planning algorithms to generate distance-optimal collision-free paths for the vehicle from an occupancy grid map. The software was designed to be as computationally efficient as possible to run seamlessly on the Snapdragon 801 chipset.

Technical Summary

I have extensive experience with robotics development on quadrotors and ground robots in the realms of controller architecture design, motion planning and trajectory generation. 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 **MATLAB** and **Simulink** models for analysis and design. I have primarily developed software for ARM-based processors running Linux/FreeRTOS environments.

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