Guidelines & Expectations for Undergraduate & MS Research

Advanced Robotics and Control Laboratory

Vanderbilt University

What We Do

Our research is focused on dynamics and control for the invention of novel robots and human performance augmentation. We work on fundamental concepts – **dynamics & control** –and novel devices – **robots** – to augment human strength, speed, and mobility.

You can find an introduction to what we do here:

- **New Theory of Human Performance Augmentation (Paper, News)**
- **Compliant Actuators for Next-Generation Robots (Paper, Video)**
- **Optimal Control makes Robots Similar to Humans (Paper, Video, Video)**
- **Robots Teaching Robots (Paper, Video)**

We are excited to involve Undergraduate and Master's students in these projects. Below you will find the guidelines to apply and the expectations to work in the Advanced Robotics and Control Laboratory.

Who We Seek

Are you interested in robots? Does human performance augmentation sound fascinating to you? The **Advanced Robotics and Control Laboratory** might be a place to start your research adventure.

We are interested in highly motivated, curious, resourceful, responsible, and independent individuals to join our team. Field-specific prior experience and knowledge is a definite advantage but it is not required. **Willing to learn new things** is required and a **strong commitment to your research** is also required. We want your **curiosity** to lead you into the unknown and your **perseverance** to tackle the challenges with us.

How to Apply

Send an email to Prof. Braun (david.braun@vanderbilt.edu). Include the following:

1. Subject Line: Research Opportunity Spring 2021

2. Body of the Email: Include name, year and major, expected graduation date, GPA, research interests, when to start, course load, relevant skills, contact info. Answer the following three questions:

- Why do you want to research with us?

- Which project interests you?
- What is the one thing that you are the best at in the school?

3. Attachment: A single PDF attachment (which can contain multiple pages) with the following information:

- Resume or CV
- Unofficial transcript
- Shortlist of references and their contact information (2 is fine)

You can apply at any time, but preferably before the beginning of a semester.

What To Expect

Subject to the availability of projects and space in the lab, **you will be invited to meet with Prof. Braun in person to discuss the details.**

If you join the Advanced Robotics and Control Lab, you will be mentored by Post-doc researchers or Ph.D. students. You will be expected to learn essential skills before you work on your independent project.

The project you will work on depends on your interest. You can find some of the potential projects here: **https://lab.vanderbilt.edu/arclab/**

Here are the basic tools we use and you may likely learn: (1) MATLAB (solving equations), (2) Mathematica (deriving models), (3) LaTeX (preparing reports and papers), (4) Adobe Illustrator (preparing figures) Photoshop (editing photos), Premiere (preparing videos), (5) SolidWorks (creating designs).

What is the Time Commitment

You are expected to spend at least **12 hours/week**. Similar to classwork, the more effort and time you commit to research, the more proficient you will be with the new skills. However, unlike classwork, **research requires dedication, adventure in the unknown, and asks for perseverance and patience.**

Research typically requires 2-3 months to get oriented to the lab and acquire basic skills and knowledge relevant to the field. Therefore, you should be prepared to **commit to a minimum of 2 semesters of research (ideally sequential semesters).**

You are required to discuss your weekly progress with your mentor (Post-doctoral researchers or Ph.D. students) on a form you both agree.

What is the ideal outcome of your research

- Create a new robot design
- Invent a new control method or a new apparatus and file a patent application.
- Publish a scientific paper at a top international conference or journal.

What is the benefit of doing research

- Learn engineering and science beyond what is expected in your classes.
- Learn how to working with others (even if you do it remotely due to COVID).
- If you do great research, your work will be acknowledged by the scientific community, and will help you secure a great job or a position at a top graduate school (where a good GPA alone is not enough)!

What are the possible research opportunities

- **Your research can count as Technical Elective.**

  a. Undergrad students: ME 3860

  b. Master of Engineering students: ME 7899

  c. Master of Science students: ME 7999

- **You can be a paid researcher if you demonstrate expertise and commitment after the first semester you work with us.**

  a. **Vanderbilt Undergraduate Summer Research Program**

  b. **Vanderbilt University School of Engineering Summer Research Program**

  c. Full-time summer research supported by external research funding

What are the Deliverables

- **A final formal-written report** in journal paper format.
- **A PowerPoint presentation** to the lab.
- Additionally, **one or more of the following**:
  a. Experimental results
  b. Functional prototype
  c. Derivation
  d. Software
  e. Simulation

If you are perusing Honors Degree, a formal written report is required. Please notify Prof. Braun in the beginning.