Student's Guide to Conducting Engineering Research

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Canada and China

Map not to Scale
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Canada and Vancouver
UBC Campus in Vancouver
Governing Factors of Researching

• Research Area
• Your Interests
• Your Background and Preparation
• Your Supervisor
• Research Environment (University, Lab, City, Country, etc.)
• Resources, Infrastructure, Funding
• Group Dynamics
1. Identify a research area and topic
2. Discuss with your supervisor (Get input; modify if necessary)
3. Literature search; Identify 10 best pertinent publications
4. Write a report summarizing the literature search
5. Prepare a research proposal (with milestones and timelines)
6. Do research; document (write weekly reports); discuss with supervisor regularly
7. Make presentations to your group (weekly) and department (1 or 2 per year) and get feedback
8. Write and present conference papers
9. Write journal papers
10. Write thesis (chapters may originate from reports)
Considerations in Selecting Your Research Topic

1. Supervisor’s suggestion
2. Constrained by the agency that funds the research project
3. Hot areas in the field
4. Check the strategic areas of research within the funding agencies of various countries
5. Your specific interest
6. Your literature search
7. Suggestion of your employer (for those who are on leave from employment)
Challenges

- Application orientation (for engineering)
- Equipment acquisition delays (for experimental research)
- Experimental setup development
- Equipment malfunctions and breakdowns
- Lack of prior research on the topic
- Coping with academic needs (courses, etc.)
- Coping with personal and family issues (including financial)
- Personality issues with group members, supervisor, etc.
- Health issues
Teamwork and Collaboration (one person will not possess all the required expertise)

Advanced sensing, actuation, and intelligent control technologies

Multi-domain and multi-functional modeling

Concurrent, multidisciplinary, and multi-criteria design and optimization

Incorporation of reliability, manufacturability, controllability, sustainability, etc. into design

Fault prediction, detection, diagnosis, accommodation, and design evolution
Industrial Automation Laboratory
University of British Columbia
Research Areas of My Group

- Cooperative Multi-Robotic Systems for Emergency Rescue Operations
- Homecare Robotics with haptic teleoperation
- Mechatronic Design
- Mechatronic Design Evolution
- Industrial Applications
- Sensors, Actuators, Instrumentation, System Integration
- Controls including Intelligent Control and Soft Computing (Fuzzy Logic, Neural Networks, Evolutionary Computing)
Example Projects in Our Lab

- Intelligent Iron Butcher (B.C. Packers, NSERC)
- Router Table Control (PRECIX Advanced Cutting Technologies, NSERC)
- Intelligent Grading Machine for Herring Roe (B.C. Packers, NSERC, Science Council of BC)
- Automated Detection of Can Defects (Neptune Dynamics, NSERC)
- Intelligent Control of a Wood Drying Kiln (NRC)
- Multi-module Deployable Manipulator System - MDMS (Canadian Space Agency, NSERC)
- Cooperative Multi-Robotic Systems for Human Rescue; Homecare Robotics with Haptic Control (CRC, NSERC, SRO, CFI)
- Design evolution
Robotic Equipment in Our Lab

Pioneer Mobile Platforms and CRS Robot
Robotic Equipment in Our Lab (New Arrivals)

- 6 dof RobuArm on Mobile Platform
- 6 dof Phantom Haptic Interface
- 6 dof Harmonic Arm
In-House Developed Robotic Manipulators in Our Lab
Robot-Assisted Search & Rescue: Our final AIM
Planned Homecare Robotic System

Diagram showing the integration of various components such as a Family Clinic, Pharmacy, Supermarket, Ambulance, and Remote Doctor at the Hospital, all connected through a Communication Network.
Intelligent Iron Butcher

- Secondary camera
- Primary camera
- Vertical cutter blade
- Discharge hopper
- Electro-hydraulic manipulator
Intelligent Herring-Roe Grader
Open Invitation to Scholarship Students

- If you come with a full scholarship (e.g., Government Scholarship) I will provide an additional $5,000/year
- I will recommend you for a teaching assistantship
- I will recommend you for an Entrance Scholarship
- We have many international students with full scholarships from their countries.
“Learning is just the progressive realization of our ignorance”

Albert Einstein
Thank you!

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