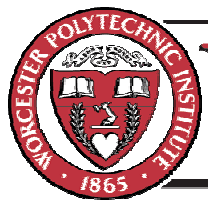
The M.S. Degree in Robotics Engineering

A multidisciplinary degree spanning
Computer Science,
Electrical and Computer Engineering,
and Mechanical Engineering



WPI

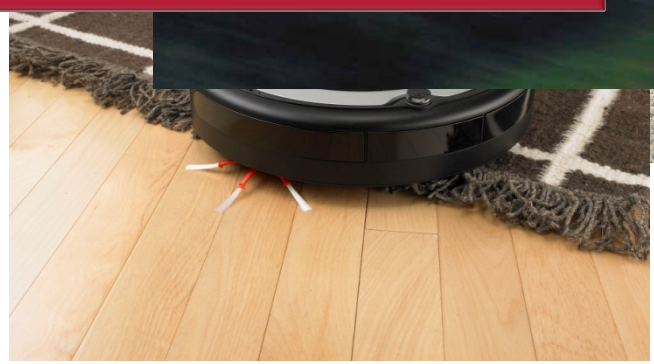
Robotics

B.S. in Robotics Engineering
Approved by the WPI Faculty in fall 2006.

M.S. in Robotics Engineering
Approved by the WPI Faculty in spring 2009.

The first RBE B.S. program in the United States.

The first institution offering both B.S. and M.S. Robotics Engineering programs in the United States.



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Robots take many forms

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WPI and Robotics Engineering (RBE)

- RBE is fundamentally multi-disciplinary
  - Innovative and immersive approach to intermingle CS, ECE and ME while maintaining a strong traditional-core engineering education
- RBE is rooted in practice as strongly as in theory
  - Project experience and industry research relationships are essential for an effective RBE graduate
- WPI with its history of innovation, emphasis on project-oriented education, flexible curriculum, and industrial ties, is the perfect university to undertake the education of future roboticists.

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Computer Science

- Software engineering and systems (not just "programming")
- Human interfaces, graphics and animation
- Computer networks
- Database and knowledge systems
- Artificial intelligence

- …**Robotics**

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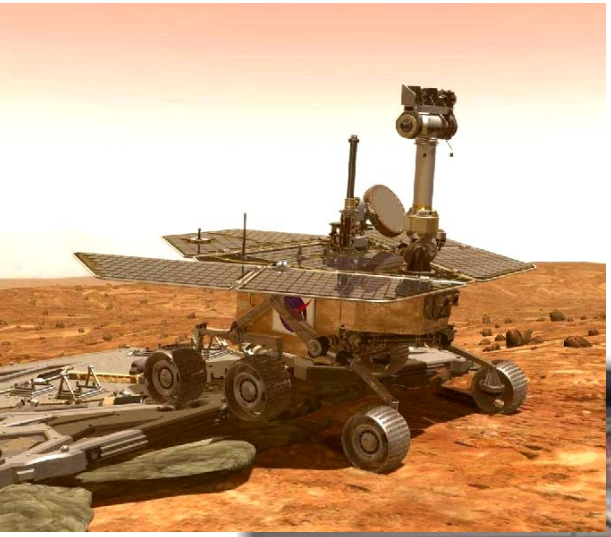
Electrical & Computer Engineering



- Electric Power
- Information
  - Computers
  - Networking and Communications
  - Video, Audio… any entertainment
  - Cryptography
- Sensors and Systems
  - Aerospace and Navigation
  - Radar, Sonar, Inertial
  - Environmental
- Computer Engineering
- Circuits and Systems
  - Micro and Nano-electronics and photonics

- **…Robotics**

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Mechanical Engineering

- Energy
  - Energy transformation
  - Renewable sources
- Materials
  - Biomaterials, structural materials, smart materials
- Machines
  - Air, space, land, water vehicles

- **…Robotics**

The Robotics Industry

"The epicenter of Robotics is in New England."
--Helen Greiner
Co-founder, iRobot
Founder and CEO, The Droidworks

- New England, and Massachusetts in particular, houses a strong and growing Robotics industry.
  - Sales exceed **$942 million**
  - Employ **2,500 in Massachusetts**
  - **40% companies are startups or less than 6 years old**
  - Average annual growth rate **47%**
  - **90% of all hires are local hires**
  - **70% plan to hire in next 1–2 years**

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Robotics Engineering Advisory Board

- David Kelly, President, Bluefin Robotics
- Helen Greiner, Founder and CEO, The Droidworks
- Brian Hart, President, Black-I Robotics
- Dean Kamen, Founder and President, DEKA Research and Development Corp.
- Dan Kara, President, RoboticsTrends
- Etc…

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Goals & Objectives

- **Goal**

  Prepare men and women for technical leadership in the robotics industry and research in robotics.

- **Objectives**
  - Solid understanding of the fundamentals of Computer Science, Electrical and Computer Engineering, Mathematics, and Mechanical Engineering
  - Awareness of management and systems contexts
  - Advanced knowledge in selected areas of robotics, culminating in a capstone research or design experience.

Credit Requirements

	MS Thesis	MS Non-Thesis	BS/MS
Robotics Core	15	15	15
Engineering Context	6	6	6
Electives	6	9	9
Thesis	9	–	–
Capstone Design / Practicum	–	6	6
Double Count	–	–	(12)
Total	36	36	24

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Detailed Requirements

- Robotics Core (15 credits)
  - Foundations (2 courses):
    - RBE 500 Foundations of Robotics
    - RBE 501 Robot Dynamics
  - CS (1 course):
    - CS 509 Design of Software Systems,
    - CS 534 Artificial Intelligence
    - CS 546 Human-Computer Interaction
  - ECE (1 course):
    - ECE 502 Analysis of Probabilistic Signals and Systems
    - ECE 503 Digital Signal Processing
    - ECE 504 Analysis of Deterministic Systems
  - ME (1 course):
    - ME523 Applied Linear Control
    - ME527 Dynamics
    - ME623 Applied Nonlinear Control

Detailed Requirements (cont)

- Engineering Context (6 credits)
  - Management (1 course):
    - ETR 592 New Venture Management And Entrepreneurship
    - MIS 576 Project Management
    - MKT 563 Marketing of Emerging Technologies
    - OBC 511 Interpersonal and Leadership Skills for Technological Managers
    - OIE 546 Managing Technological Innovation
  - Systems Engineering (1 course)
- Capstone Design / Practicum (6 credits) or Thesis (9 credits)
- Electives (6-9 credits)

Courses

- RBE 500. Foundations of Robotics

  Mathematical foundations and principles of processing sensor information in robotic systems.

- ME/RBE 501. Robot Dynamics

  Foundations and principles of robotic manipulation.

- RBE 595. Special Topics

  Arranged by individual faculty with special expertise

- RBE 596. Robotics Engineering Practicum
- RBE 597. Independent Study
- RBE 598. Directed Research
- RBE 599. Thesis Research

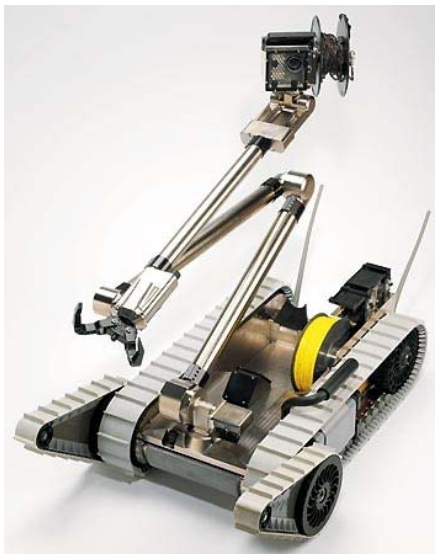
Internship Opportunities

NASA

iRobot

Boston Dynamics

BOSS



BAE SYSTEMS

DRS TECHNOLOGIES

DELL

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Robotics Honor Society

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Faculty & Research I

David Brown, CS
The Application of AI to Design;
Human-Computer Interaction & Interface Design;
Design Theory & Methodology;
Artificial Intelligence

Michael J. Ciaraldi, CS
Robotics Education;
Software Engineering;
Real-Time and Embedded Systems;

Eben C. Cobb, ME
Computer Aided Design and Kinematics;
Smart Structures;
Vibration Control;
Design of High-Speed Precision Equipment

David Cyganski, ECE
Machine Vision;
Automatic Target Recognition;
Image Fusion; Network Computing;
Multimedia;
Computers In Education

Michael A. Demetriou, ME
Control of Mobile Sensor and Actuator Networks;
Intelligent Control of Robotic Manipulators;
Model-Based Intrusion and Biochemical Source Detection Using Mobile Sensors

Gregory Fischer, ME
Medical Robotics;
Computer Assisted Interventional Systems;
MRI-Compatible Mechatronics;
Modeling And Control Of Robotic Systems;
Kinematics And Mechanism Design

Michael A. Gennert, CS
Robotics Education;
Computer Vision;
Image Processing;
Programming Languages

Islam Hussein, ME
Cooperative Control of Intelligent Multiple Vehicle Sensor Network Systems;
Geometric Mechanics; Optimal Control Theory

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Faculty & Research II

Robert W. Lindeman, CS & IMGD
Human-Computer Interaction;
Human-Robot Interaction for Teleoperation

Fred J. Looft III, ECE
Instrumentation;
Digital and Analog systems;
Signal Processing;
Biomedical Engineering;
Microprocessor Systems and Architectures;
Space-Flight Systems

William Michalson, ECE & CS
Communications and Navigation Systems;
Embedded Computing / Real-Time Systems;
Networking and IT Infrastructure

Robert L. Norton, ME
Mechanical Design and Analysis;
Dynamic Signal Analysis;
Computer Aided Engineering and Design;
Vibration Analysis

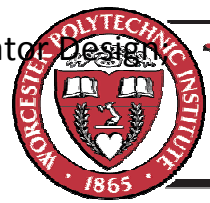
Taskin Padir, ECE
Modeling and Control of Robotic Systems;
Kinematics and Dynamics of Robot Manipulators;
Redundancy Resolution and Trajectory Planning;
Machine Vision

Gary Pollice, CS
Software Engineering;
Quality and Testing;
Collaborative Development and Processes

Charles Rich, CS &IMGD
Human-Robot Interaction

Gretar Tryggvason, ME
Robotics Education;
Computing;
Entrepreneurship

James D. Van de Ven, ME
Propulsion Systems,;
Energy Storage;
Kinematics Including Manipulator Design



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The Future

"Within 25 years there will be no activity, legal or illegal, that we will undertake without the assistance of a robot."

Now planning PhD in Robotics!

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For more information:

http://robotics.wpi.edu

Watch this site regularly for updates and announcements!

Questions?