AC 2008-1048: THE NEW ROBOTICS ENGINEERING BS PROGRAM AT WPI

Michael Ciaraldi, Worcester Polytechnic Institute

Eben Cobb, Worcester Polytechnic Institute

David Cyganski, Worcester Polytechnic Institute

Michael Gennert, Worcester Polytechnic Institute

Michael Demetroiu, Worcester Polytechnic Institute

Fred Looft, Worcester Polytechnic Institute

William Michalson, Worcester Polytechnic Institute

Bradley Miller, Worcester Polytechnic Institute

Yiming Rong, Worcester Polytechnic Institute

Lance Schachterle, Worcester Polytechnic Institute

Kenneth Stafford, Worcester Polytechnic Institute

Gretar Tryggvason, Worcester Polytechnic Institute

James Van de Ven, Worcester Polytechnic Institute

The New Robotics Engineering BS Program at WPI

Worcester Polytechnic Institute
100 Institute Rd.
Worcester, MA 01609

Abstract

In the spring of 2007, Worcester Polytechnic Institute introduced a BS degree program in Robotics Engineering. The degree program is a collaborative effort, involving faculty from the departments of Computer Science, Electrical and Computer Engineering and Mechanical Engineering. The motivation for establishing the program is two-fold: needs of the rapidly growing robotics industry and student interest as demonstrated by numerous high school robotics competitions. The program relies in part on already existing courses, but the core curriculum consists of five new "unified robotics engineering" courses. Although Robotics Engineering is not recognized as a distinct engineering field by ABET, the program is designed to be accreditable under the "General Engineering" ABET criteria. While the program is less than a year old, there is already significant student interest.

1.0 Introduction

Robotics—the combination of sensing, computation and actuation in the real world—is on the verge of rapid growth, driven by both supply and demand. The supply side is driven by decreasing cost and increasing availability of sensors, computing devices, and actuators. The demand side is driven by national needs for defense and security, elder care, automation of household tasks, customized manufacturing, and interactive entertainment. Engineers working in the robotics industry are mostly trained in one of Computer Science, Electrical and Computer Engineering, or Mechanical Engineering. However, as an inherently interdisciplinary activity, no single discipline provides the breadth demanded by robotics in the future. Truly smart robots rely on information processing, decision systems and artificial intelligence (computer science), sensors, computing platforms, and communications (electrical engineering) and actuators, linkages, and mechatronics (mechanical engineering). To realize products, some training in management is also important and we argue that a science and social science background could be important as well as applications in the biological sciences and medicine, for example, offer enormous obvious opportunities for micro-robotics, tele-robotics and agile prostheses and advanced human interaction techniques.

Many Computer Science, Electrical and Computer Engineering, and Mechanical Engineering programs offer minors and other forms of robotics course concentrations within traditional programs. It is our thesis, however, that only a fully multidisciplinary program consisting of a core of courses in which all these components are intertwined on a daily basis is appropriate for education of the leaders and entrepreneurs needed by this nascent industry. For this reason, we have recently introduced a program leading to a bachelor degree in Robotics Engineering at the Worcester Polytechnic Institute. This is, as far as we know, the first such program in the United States. The program was approved by the faculty in the fall of 2006 and the WPI Board of Trustees in March of 2007. Although the window between the formal approval of the program and the deadline for admitting students was relatively short, students admitted for Fall 2007 had the option of declaring the program as an intended major.

The main motivation for the new program is the belief that economic benefit of smart electromechanical systems will be reaped by those individuals and nations that can convert technological know-how into products. To do so, technological proficiency is necessary, but not sufficient. The added ingredient is the presence of individuals with the creativity to imagine new products, the preparation to engineer them and the desire to see the products to market. The new B.S. degree in Robotics Engineering will provide a solid foundation in state-of-the-art technology, give sufficient hands-on experience to build confidence and stimulate the imagination, and foster the entrepreneurial spirit that leads to the establishment of start-up companies and creation of jobs.

2.0 Why robotics engineering?

The decision to create a new major in robotics engineering was the result of intense discussion among a group of faculty who believe strongly that robotics is just about to change our lives. The group sought input from a wide range of other individuals, both in industry and academe, before deciding to develop the new major. The main reasons for going ahead are summarized below:

Interdisciplinary: It seems obvious that designing devices that marry sensing, computing, and acting requires individuals who have a background in electrical and computer engineering, computer science, and mechanical engineering. Such individuals are rare and, just as obviously, not every topic usually taught in these disciplines is as important as others for the design of robots. Furthermore, design of robots requires emphasis on system integration that goes beyond that usually included in an undergraduate study in the traditional disciplines. Thus, there is a need for a separate discipline. In Japan and Europe, mechatronics has been used to describe the fusion of mechanical and electrical engineering, with computing presumably implied. Mechatronics has, however, not caught on in the US.

Attracting students: While mechatronics is an obscure technical term, robotics is something that everyone can relate to. It is well understood to involve a broad range of automatic and autonomous devices (industrial robots, mobile robots, and vacuum cleaners, for example) and robotics resonates strongly with a generation brought up with computers and the Internet. Robotics competitions are perhaps THE way to generate excitement about science and technology among high school students. Thus, robotics may well be an important component in attracting more students into engineering. Furthermore, as robotics can have a role in directly improving the lives of individuals (robotics will play a major role in assistive technology, for example) it may help draw more women into engineering. As indicators of the level of interest in robotics among high school students, we cite the following statistics:

- In 2006, over 28,000 high-school students competed in FIRST Robotic Competition and another 6,000 mostly high school students competed in FIRST Vex Challenge[1].
- FIRST Robotic Competition reached over 30,000 high-school aged students in 2007[2] and FIRST Vex Challenge projects to reach over 25,000 students within a few years[3].
- Botball robotic soccer competitions have included over 34,000 students to date[4].

- BattleBots IQ (numbers unknown) has been going on since 2000, claiming to have "hundreds" of high schools involved[5].
- Other robotics events, such as Robocup (numbers unknown) and Boosting Engineering, Science and Technology (BEST) Robotics with 8,000 students yearly[6], also illustrate the high level of interest.
- The robots.net Robotics Competition web page lists over hundred competitions in 2008[7]. Note that FIRST counts as a single entry, despite its multiple dates and venues.

At WPI many entering students have recently expressed an interest in robotics. During the academic year 2006/07, for example, over 130 visiting prospective students listed robotics either as a principal interest area or as their planned major on WPI Admissions Information forms. In Fall 2005 and 2006, 96 and 101 freshmen, respectively, joined the WPI Robotics Team. One-third of them stated an interest in pursuing robotics for their senior project or academic major. 43% had known of the WPI/FIRST/robotics connection before enrolling at WPI and 62% of these indicated that this knowledge was a strong positive reason for selecting WPI.

3.0 Education in Robotics

One may date the earliest robotics-related undergraduate curricula to the 1980's where the primary focus was on mechanics, kinematics and control, with the primary paradigm of a two-link manipulator. Classical books, such as *Introduction to Robotics: Mechanics and Control*[8] focused primarily on manipulator dynamics and kinematics. The application side of such a course was implemented in Mechanical, Industrial and Manufacturing Engineering programs where industrial robots were examined within the context of assembly line manufacturing. Another class on introductory robotics books examined cognitive aspects as an application of AI, such as *The Psychology of Computer Vision*[9]. During the 1990's additional courses were introduced with more sophisticated control theories (fuzzy neural network controllers, adaptive controllers) being the newer focus[10]. In the late 90's and throughout the 2000's advanced courses on robotics dealt with path planning, navigation, autonomy, communication and in general all aspects of mobile robots[11]. At the same time, one witnessed the use of robotic kits, such as Lego[12,13] and BOE-bot[14] in science fairs and science museums in encouraging K-12 students in science and as an eventual vehicle of further study in SMET disciplines.

4.0 The Robotics Engineering Program at WPI

The Robotics Engineering Program at WPI is a new program that will educate young engineers for the robotics industry and prepare students for graduate work in robotics. The goals of the program are to:

- Educate young engineers for the robotics industry and prepare students for graduate work in robotics,
- Leverage FIRST, BattleCry, and other robotics competitions to capture the imagination of secondary school students and their parents to draw a diverse student body to the field of engineering,
- Contribute to the growth of the robotics industry,
- Attract outstanding faculty to this new and growing field, and
- Stimulate research in robotics.

We hope that other universities will model new robotics programs on our example. The specific program objectives have been selected to produce a program that is not only attractive for its technical strength, but also seeks to prepare individuals for leadership roles in the industry. Thus, the program objectives are to educate men and women to:

- Have a basic understanding of the fundamentals of Computer Science, Electrical and Computer Engineering, Mechanical Engineering, and Systems Engineering.
- Apply these abstract concepts and practical skills to design and construct robots and robotic systems for diverse applications.
- Have the imagination to see how robotics can be used to improve society and the entrepreneurial background and spirit to make their ideas become reality.
- Demonstrate the ethical behavior and standards expected of responsible professionals functioning in a diverse society.

Thus, the program tackles head-on the challenges of providing engaging experiences for students with diverse backgrounds identified in the National Research Council Report[15].

The essence of the program is captured in five courses, consisting of Introduction to Robotics at the 1000 level (1st year) followed by a four-course Unified Robotics engineering core sequence at the 2000 and 3000 levels (sophomore and junior years). Other courses are required from each of the participating departments to ensure technical breadth and strength. The new required courses are:

RBE 1001 INTRODUCTION TO ROBOTICS
Multidisciplinary introduction to robotics, involving concepts from the fields of electrical engineering, mechanical engineering and computer science. Topics covered include sensor performance and integration, electric and pneumatic actuators, power transmission, materials and static force analysis, controls and programmable embedded computer systems, system integration and robotic applications. Laboratory sessions consist of hands-on exercises and team projects where students design and build mobile robots.

RBE 2001 UNIFIED ROBOTICS I
First of a four-course sequence introducing foundational theory and practice of robotics engineering from the fields of computer science, electrical engineering and mechanical engineering. The focus of this course is the effective conversion of electrical power to mechanical power, and power transmission for purposes of locomotion, and of payload manipulation and delivery. Concepts of energy, power and kinematics will be applied. Concepts from statics such as force, moments and friction will be applied to determine power system requirements and structural requirements. Simple dynamics relating to inertia and the equations of motion of rigid bodies will be considered. Power control and modulation methods will be introduced through software control of existing embedded processors and power electronics. The necessary programming concepts and interaction with simulators and Integrated Development Environments will be introduced.

Laboratory sessions consist of hands-on exercises and team projects where students design and build robots and related sub-systems.

RBE 2002 UNIFIED ROBOTICS II
Second of a four-course sequence introducing foundational theory and practice of robotics engineering from the fields of computer science, electrical engineering and mechanical engineering. The focus of this course is interaction with the environment through sensors, feedback and decision processes. Concepts of stress and strain as related to sensing of force, and principles of operation and interface methods for electronic transducers of strain, light, proximity and angle will be presented. Basic feedback mechanisms for mechanical systems will be implemented via electronic circuits and software mechanisms. The necessary software concepts will be introduced for modular design and implementation of decision algorithms and finite state machines. Laboratory sessions consist of hands-on exercises and team projects where students design and build robots and related sub-systems.

RBE 3001 UNIFIED ROBOTICS III
Third of a four-course sequence introducing foundational theory and practice of robotics engineering from the fields of computer science, electrical engineering and mechanical engineering. The focus of this course is actuator design, embedded computing and complex response processes. Concepts of dynamic response as relates to vibration and motion planning will be presented. The principles of operation and interface methods various actuators will be discussed, including pneumatic, magnetic, piezoelectric, linear, stepper, etc. Complex feedback mechanisms will be implemented using software executing in an embedded system. The necessary concepts for real-time processor programming, re-entrant code and interrupt signaling will be introduced. Laboratory sessions will culminate in the construction of a multi-module robotic system that exemplifies methods introduced during this course.

RBE 3002 UNIFIED ROBOTICS IV
Fourth of a four-course sequence introducing foundational theory and practice of robotics engineering from the fields of computer science, electrical engineering and mechanical engineering. The focus of this course is navigation, position estimation and communications. Concepts of dead reckoning, landmark updates, inertial sensors, vision and radio location will be explored. Control systems as applied to navigation will be presented. Communication, remote control and remote sensing for mobile robots and tele-robotic systems will be introduced. Wireless communications including wireless networks and typical local and wide area networking protocols will be discussed. Considerations will be discussed regarding operation in difficult environments such as underwater, aerospace, hazardous, etc. Laboratory sessions will be directed towards the solution of an open-ended problem over the course of the entire term.

Of those, RBE 1001 has been taught several times, and RBE 2001 and RBE 2002 are being taught for the first time this academic year. RBE 3001 and RBE 3002 will be taught for the first time during the 2008/2009 academic year.

Various approaches and methods have been utilized to introduce students to robotics. Many schools capitalized on the appeal of robots to introduce students to aspects of computation and engineering. Our unified robotics core course sequence can leverage their work by adapting course materials and adopting textbooks, as appropriate. The third Unified Robotics core course, RBE 3001 Unified Robotics III, for example, shares many common elements with a traditional Mechatronics course, as offered in many institutions. A primary example is Colorado State University's ME307 Mechatronics and Measurement Systems, which uses *Mechatronics and Measurement Systems* by Histand and Alciatore[16], supplemented by an extensive laboratory manual[17]. For our purpose, this material will be adapted and adjusted to fit a more robotics-oriented, as opposed to strictly mechatronics-oriented, student audience. The fourth and final of the Unified Robotics core courses, RBE 3002 Unified Robotics IV, will also draw upon several sources for material. Harvey Mudd College introduces students to computational interaction with the physical environment in a course, CS154 Robotics, which was developed with partial support of a DUE grant from NSF. It uses the text *Probabilistic Robotics* by Thrun, Burgard and Fox[18], which has also been successfully used at Stanford University. The course at Stanford, CS329 Statistical Techniques in Robotics, explores mobile robotics from a statistical perspective and enables students to understand the limitations and capabilities of the statistical techniques in mobile robots. *Introduction to Mobile Robots* by Siegwart and Nourbakhsh[19] has been successfully used at CMU in the course CS16761 Introduction to Mobile Robots, which introduces students to the fundamentals of mobile robotics, spanning mechanical, motor, sensory, perceptual and cognitive layers. The authors provide additional resources, such as a sample curricula, robot platforms and programming on their web site[20]. Harvey Mudd's CS154, Stanford's CS329 and CMU's CS16761, together with their associated textbooks, will be used by us to develop RBE 3002 Unified Robotics IV.

Research on engineering education has provided us with a considerable understanding of the many issues involved in keeping students interested in engineering, delivering the material effectively and stimulating creativity. It is, in particular, fairly well established that the structure of the curriculum plays an important role in overall student satisfaction and retention and that early introduction to engineering generally helps[21,22,23]. It is also well understood that different teaching methods appeal to different learner types and that generally all people learn more in an environment where the material is presented in a variety of ways[24,25] and that creativity and innovation can be taught, or at least stimulated, in a properly structured course[24,26,27,28]. The robotics course sequence (consisting of an introductory course and four unified courses) offers early introduction, the courses consists of a blend of lectures and projects, emphasize creativity and innovation, and focus on technology that has an obvious impact on how people live.

In a new industry, there are enormous opportunities for new ideas and new products. To encourage students to become "enterprising engineers"[29], we require a course in Entrepreneurship. Although one course certainly is not sufficient for those who intend to form their own businesses, we strongly believe that engineers need to "think outside the cubicle" and must understand the business contexts within which they operate. This is important not only for entrepreneurs who deal with venture capitalists, lawyers, and other financial and marketing resources to start up new companies, but also for intrapreneurs who generate new business ideas and plans to present to senior management within their existing companies. Thus, this course could include identifying ideas for new businesses, feasibility analysis, evaluation for appropriateness, and business plan development. Industry has reacted with great enthusiasm to the entrepreneurship component.

In addition to taking courses, WPI requires all students to complete a senior-level project in their major field of study. For RBE students, this constitutes a capstone design experience in Robotics Engineering. Students typically work in teams of two to four students, although single-person projects and larger teams are also possible. A faculty member in the major advises the work. Students are expected to take relevant coursework before the project begins. The project work itself typically starts with a formal project proposal, including literature review, clearly defined approach, and schedule with milestones. Projects conclude with a report and presentation to faculty and students. Many project reports become conference papers; having students at all levels as co-authors is highly valued at WPI. Project ideas come from several sources: faculty may have topics that relate to their research or other interests, industry often sponsors projects (and is charged a project fee for the privilege), and students may explore their own project ideas with faculty approval. Industry sponsored projects are particularly valuable since the sponsor gets a close look at a potential future hire and also gets the opportunity to implement a small project that they otherwise lack the staff to commit to. Students enjoy the experience and find themselves well-prepared for future employment or graduate school. Even before the introduction of the RBE program, students from various majors have been working on robotics projects, such as a solar-cell/rechargeable fuel cell powered robot and a roof inspection robot.

5.0 Resources

The Institution had already made a significant commitment to robotics by sponsoring a FIRST high school team and other robotics competitions. Thus, a significant part of the time of two staff members was already devoted to robotics (the rest was used to support other student projects) and currently these two members are fully dedicated to robotics in a combination of supporting the RBE program as well as continuing support for pre-university competitions. The rest of the support comes from reallocating faculty time, providing laboratory space, and a small amount of operating funds. The program is lead by the department heads from Computer Science, Electrical and Computer Engineering, and Mechanical Engineering as well as other faculty members from these departments. The courses are being designed and taught by an interdepartmental faculty team from all three departments and we are currently searching for a faculty member explicitly identified as holding a joint appointment.

In addition to resources committed by the Institute, we have sought and received external support for two related activities. One is a small pilot grant to work with FIRST to strengthen social networking among teams in the competition. This is particularly important for rookie teams who do not possess the experience of those who have participated for several years. Although most teams share their experience freely (in the spirit of co-opetition promoted by the organizers) this is mostly on ad-hoc basis. The current project has two components: one is to make material available to teams in a way that is easily accessible and the other is to understand the dynamics by which teams (new and experienced) network. The gathering (and generation where needed) of material includes assembling information about how to organize and motivate teams as well as more technical information. The technical information obviously is also useful for students in the RBE program. The other effort is more directly integrated with the program and involves holding an annual robotics innovation conference and competition. This effort flows directly from our conviction that finding new applications for robotics—and new ways to handle old applications—is what will drive explosive growth of the robotics industry. The **Robotics Innovations Competition and Conference** will challenge students to design and build robots to perform useful and novel tasks through a university-level competition. Entrants will be judged primarily on the extent to which they meet existing needs or create new markets, and secondarily with respect to design and analysis, implementation skill, and business plans. While robotics competitions exist at the K–12 and university levels, these are notably based on games with a fixed set of rules. We believe that existing competitive games do not suffice; what is needed is a competition that emphasizes the engineering of solutions to open-ended real-world problems and that invites creativity by an open competition based on the intellectual and commercial and/or humane aspects of the solutions. Undergraduate and Graduate students from all engineering disciplines would participate in the competition as well as in the preparatory workshops and concluding conference.

6.0 Assessment Plans

The RBE program has only been in existence for a short time and while we have every intention of assessing its success in a variety of ways, for the most part there is little data yet. The most critical question: will there be student interest does, however, appear to have been answered in the affirmative. As of late January 2008, over sixty freshmen have declared RBE as their major. This makes the program comparable in size to many of the more traditional engineering disciplines at WPI. This is, obviously, the feedback that we are most interested in at this stage. We have also received both formal (student evaluations) and informal feedback on the first two courses. The feedback is generally very positive, although there have naturally been a few minor “bumps.” Perhaps the most interesting feedback, and the one we are currently working on, is that the student are anxious to see robotics applications very tightly woven into the presentation of essentially all the course material. Given the somewhat abstract way that the engineering sciences are often introduced, ensuring that a possible context is always included will require some work.

7.0 Conclusions

The introduction of the robotics degree at WPI is a direct and explicit response to the success of FIRST and other robotic competitions in generating excitement among high school students, as well as to the growth of the robotics industry. We have learned several key lessons in developing the program that may be of interest to other universities considering introducing Robotics Engineering. Those include:

- Vision and passion are critical, yet cannot replace a thorough business plan when seeking administration approval. Education is a business.
- A bottom-up approach to curricular innovation is more likely to succeed than top-down. Faculty will devote enormous energy to causes they believe in.
- Stick to one’s guiding principles. For example, we were pressured to drop the entrepreneurship requirement in favor of additional technical coursework, yet that would have gutted the entrepreneurial objective, so it was retained. Not surprisingly, industry

enthusiastically concurs.

- Be willing to compromise on most anything else. For example, courses in AI and Kinematic Design could not be required without violating some principle, so they became electives.
- Communication is critical, including within the team, with other faculty, the advisory board, and administration.

Bibliography

1. http://www.usfirst.org/about/2006/FIRST_FAQ_2006_3.pdf
2. http://www.usfirst.org/robotics/
3. FIRST Vex Challenge officials teleconference communication to Ken Stafford.
4. Botball Statistics and Numbers, http://www.botball.org/about-botball/statistics_and_numbers.php
5. http://www.battlebotsiq.com/news.php
6. http://www.bestinc.org/MVC/About/what_is_best
7. http://robots.net/rcfaq.html
8. J.J. Craig, *Introduction to Robotics: Mechanics and Control*, Addison Wesley, 1986.
9. P/H. Winston, *The Psychology of Computer Vision*, McGraw-Hill, Computer Science Series, 1975.
10. F.W. Lewis, S. Jagannathan, A. Yesildirak, *Neural Network Control of Robot Manipulators and Non-Linear Systems*, CRC Press, 1998.
11. A. Meystel, *Autonomous Mobile Robots: Vehicles with Cognitive Control*, World Scientific Series in Automation, Vol. 1, 1993.
12. B. Bagnall, *Maximum Lego NXT: Building Robots with Java Brains*, Variant Press, 2007).
13. M. Ferrari, G. Ferrari, and R. Hempel, *Building Robots with Lego Mindstorms: The Ultimate Tool for Mindstorms Maniacs*, Syngress, 2001.
14. M. Predko, *123 Robotics Experiments for the Evil Genius*, McGraw-Hill/TAB Electronics, 2004.
15. National Research Council, *Evaluating and Improving Undergraduate Teaching in Science, Technology, Engineering, and Mathematics*, National Academies Press, Washington, DC, 2003. http://nap.edu/catalog/10024.html
16. D. Alciatore and M. Histand, *Introduction to Mechatronics and Measurement Systems*, 3rd edition, McGraw-Hill, 2007.
17. D. Alciatore and M. Histand, *Mechatronics and Measurement Systems Laboratory Exercises,* for the 3rd edition of textbook, Kinkos Custom Publishing, Fort Collins, 2006.
18. R. Siegwart and I. Nourbakhsh, *Introduction to Autonomous Mobile Robots*, The MIT Press, 2004.
19. S. Thrun, W. Burgard and D. Fox, *Probabilistic Robotics*, MIT Press, 2005.
20. http://www.mobilerobots.org
21. J. Margolis and A. Fisher. *Unlocking the Clubhouse: Women in Computing*, MIT Press, 2002.
22. J. Busch-Vishniac and J.P. Jaroz. *Can Diversity in the Undergraduate Engineering Population be Enhanched Through Curricular Change*. J. Woman and Minorities in Science and Engineering. 10 (2004), 255-281.
23. *Retention is a Big Issue in Engineering Education, and More Schools Are Developing Programs To Keep Students From Dropping Out*. PRISM Magazine, Wednesday, January 05, 2005. http://www.prismmagazine.org/jan05/feature_lending.cfm
24. P. C. Wankat and F. S. Oreovicz. *Teaching Engineering*. McGraw-Hill, 1993.
25. R.M. Felder. Several papers available at http://www.ncsu.edu/felder-public/
26. J. L. Adams. *Conceptual Blockbusting* 3 rd Edition Reading Mass: Addison Wesley, 1986.
27. H.S. Fogler and S.E. LeBlanc. *Strategies for Creative Problem Solving*. Englewood Cliffs, N.J.: Prentice Hall, 1995.
28. E. Lumsdaine and M. Lumsdaine. *Creative Problem Solving: Thinking Skills for A Changing World.* New York: McGraw Hill, 1995.
29. G. Tryggvason and D. Apelian. “Re-Engineering Engineering Education for the Challenges of the 21st Century.” Commentary in JOM: The Member Journal of TMS, October 2006.

Authors:
Michael J. Ciaraldi, Professor of Practice, Department of Computer Science.
Eben C. Cobb, Visiting Assistant Professor, Department of Mechanical Engineering
David Cyganski, Professor, Department of Electrical and Computer Engineering. Associate Director, Robotics Engineering Program.
Michael Gennert, Professor and Department Head, Department of Computer Science. Director, Robotics Engineering Program.
Michael Demetriou, Associate Professor, Department of Mechanical Engineering
Fred Looft, Professor and Department Head, Department of Electrical and Computer Engineering
William R. Michalson, Professor, Department of Electrical and Computer Engineering
Brad Miller, Associate Director, Robotics Resource Center, Department of Mechanical Engineering
Yiming Rong, Professor, Department of Mechanical Engineering
Lance E. Schachterle, Associate Provost and Professor of English
Ken Stafford, Director, Robotics Resource Center, Department of Mechanical Engineering
Gretar Tryggvason, Professor and Department Head, Department of Mechanical Engineering. Associate Director, Robotics Engineering Program.
James D. Van de Ven, Assistant Professor, Department of Mechanical Engineering

Ac 2008-1048: The New Robotics Engineering BS Program at Wpi. Abstract In the spring of 2007, Worcester Polytechnic Institute introduced a BS degree program in Robotics Engineering. The degree program is a collaborative effort, involving faculty from the departments of Computer Science, Electrical more.Â The motivation for establishing the program,is two-fold: needs of the rapidly growing robotics industry and student interest as demonstrated by numerous high school robotics competitions. The program relies in part on already existing courses, but the core curriculum consists of five new â€œunified robotics engineeringâ€ courses. Although Robotics Engineering is. Save to Library. by Michael Gennert. What is the WPI Robotics Library. 15 September 2008. 5. Getting Started. What is the WPI Robotics Library. What is the WPI Robotics Library.Â This is a feature in the WPI Robotics Library that helps ensure that your robot doesnâ€™t run off out of control if the program malfunctions. RobotDemo(void) {. GetWatchdog().SetEnabled(false)Â The IterativeRobot class divides your program up into methods that are repeatedly called at various times as the robot program executes. For example, the AutonomousContinuous() method is called continuously while the robot is in the autonomous mode of operation. When the robot changes state to operator control, then the TeleopInit() first, then the TeleopContinuous() method is called continuously. I'm a Student at WPI and hence my answer might be biased. I'll try to put in some facts that would help you decide it for yourself: 1. There are 11 labs, most of which are accessible to students 24/7 2. More than 20 faculty members affiliated with RBE program 3. Awesome robots! Atlas, PR2, Baxter, Motoman, Nao, Jaco, Youbot, Turtlebots(lots of those). 4. More robots: - Oryx 1 & 2, Aero, Anna (wheel chair). These are built at RIVeR lab and there are several more in other labs. Also check out Walrus. 5. Most Grad courses have a project in which you might use any of these robots (provided you hav