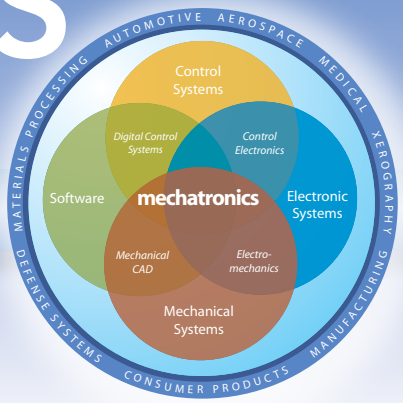
MECHATRONICS IN DESIGN

FRESH IDEAS ON INTEGRATING MECHANICAL SYSTEMS, ELECTRONICS, CONTROL SYSTEMS AND SOFTWARE IN DESIGN



Engineering Education for the 21st Century

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BY KEVIN CRAIG

Our economy, national security and indeed our everyday lives are increasingly dependent on scientific and technical innovation. The quality of engineering education has a direct impact on our ability as a nation to compete in the increasingly global competitive environment of the 21st century. The National Science Board, in November 2007, stated, engineering education must respond immediately to three challenges: the need to adapt to the changing global context of engineering; the need to change the public perceptions of engineering and the need to attract and retain top students in engineering. It also stated that a continuation of the status quo in engineering education in the U.S. is not sufficient in light of the changing workforce demographics and needs. In my view, the status quo in engineering education is characterized by three aspects: lecture-mode faculty teaching and passive student learning; the exclusive silo structure of a university College of Engineering which deprives students of exposure to all disciplines and the multidisciplinary systems nature of modern engineering; and a reward system for faculty and students that promotes marginal teaching and accepts memorization in place of true understanding.

To learn more about these issues, I recently did some traveling. Winter was persisting in Milwaukee, so a trip to California seemed like a great idea! I was very fortunate to visit the Stanford University Product Design Program and the world-known product design firm IDEO. The visit was enlightening as my hosts, David Beach, professor and co-director of the Stanford Product Realization Lab., and Dave Blakely, director of Technology Strategy at IDEO, gave freely of their time and insights. A discussion with Professor James Patell of the Stanford University Business School, who teaches courses on design for extreme affordability and is a co-founder of the Stanford Institute of Design, was awe-inspiring. I was traveling with a close friend and colleague from RPI, Burt Swersey, the award-winning innovation professor, and we spent two packed days in discussions with these and many more people at both places. I am very grateful to all those with whom we met. Soon after, I travelled to Smith College in Massachusetts to attend a workshop on Engineering, Social Justice and Peace. It was there I met Caroline Baillie, a professor at Queen's University in Kingston, Ontario, Canada. You can read about this truly remarkable person in the March 2008 *ASEE's Prism Magazine*. So, these trips left me full of excitement and very humble.

So, what's all this got to do with mechatronics? Plenty! Mechatronics is multidisciplinary systems engineering. A mechatronics' approach to engineering system design goes a long way to remedying some of these deficiencies. Basic engineering skills have become commodities worldwide. Other countries have a competitive advantage in low-cost manufacturing and services, with excellent engineers available at one-fifth of the cost of a U.S. engineer. To be competitive, U.S. engineers must provide high value by being immediate, innovative, integrative, conceptual and multidisciplinary — that is, mechatronic. Twenty-first-century engineers must have depth in a specific engineering discipline, as well as multidisciplinary engineering breadth, with a balance between theory and practice. In addition to this technological depth, they must have breadth in business and human values. Innovation in the 21st century happens at the intersection of technology, business and human values (Figure 1, left).

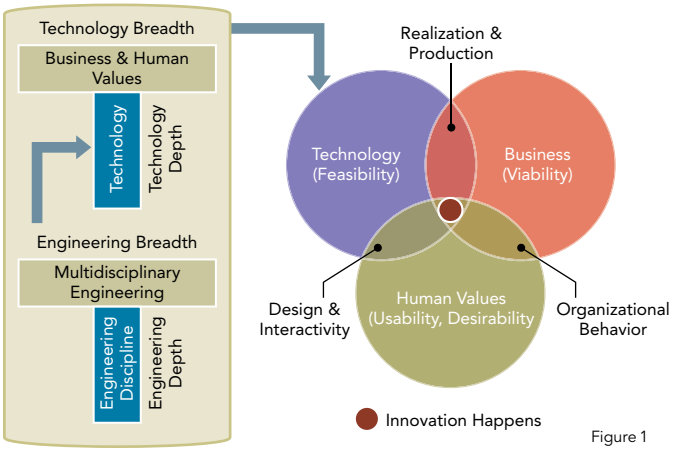

Figure 1

Innovation and the 21st-century engineer.

Engineering needs a renewed human-centered focus and along with that a face that attracts a diversity of students interested in serving people at home and worldwide. Faculty must guide students to discover engineering through the process of active investigation.

A transformation is needed — for faculty and how they view teaching, for students and how they view learning, for each engineering department and how it views its role in collaboration with other departments in preparing students to be 21st-century engineers and, lastly, for the reward system for both faculty and students to enable this transformation to take root. New generations of students, with different backgrounds, interests, skills and needs, must be enthused about the profession of engineering and better prepared, in both technical and non-technical areas, to creatively advance technology and solve the problems the 21st century presents.

Discover more ways mechatronics is helping engineering education in the 21st century: http://rbi.ims.ca/5711-518