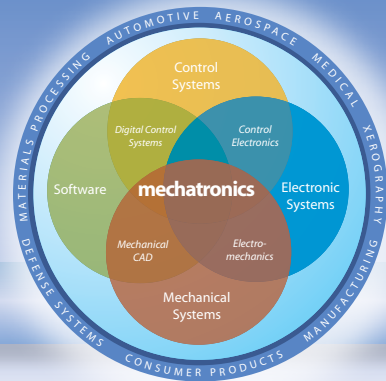


# MECHATRONICS IN DESIGN

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



## Mechatronic Mentors

As an engineer today you face daunting challenges. Your engineering problems are getting harder, broader and deeper. They are multidisciplinary and require a multidisciplinary engineering systems approach to solve them. As mechatronic engineers, you know what that means — electronics, computers and controls are integral parts. Performance, reliability, low cost, robustness and sustainability are absolutely essential. Your mechatronics' training and approach to solving problems gives you a significant advantage, a competitive edge.

Engineering educators face daunting challenges. The preparation of the new engineers you hire is inadequate for the challenge. It seems that memorization has replaced understanding. Students focus on facts, tests and grades and fail to understand concepts and processes. They are unable to integrate knowledge, processes, techniques and tools, both hardware and software, to solve an engineering problem.

How can students be transformed to become engineers poised to solve mankind's problems of the 21st century? Nothing less than dramatic changes will do. Students need to see the difference between studying engineering and becoming an engineer. They need to share responsibility, with teachers, for their education. They need to take an active role and embrace knowledge — own it — make it a part of their being. Only then do they become engineers. A transformation is also required for teachers. Teachers must become more than the "sage on the stage." At a university, it must always be about the students! Faculty must be transparent in the delivery of knowledge. They are the "guides on the side." It is never about what they know — it is always about how they can best transform their students. They must guide students to discover engineering through the process of active investigation which nurtures curiosity, initiative and risk taking; promotes critical thinking; develops students' responsibility for their own learning and habits of lifelong learning; and fosters intellectual development and maturity. In all they do, science and mathematics must receive constant emphasis with a balance between theory and practice.

What starts this transformation? What is the dramatic event that will put an engineering freshman on the right path to becoming an engineer? Here is one approach. At Marquette University new engineering freshmen — high school diplomas still fresh — will be part of a dramatic event — a three-day transformational design experience (see figure, below). Students will work in teams, mentored by Marquette engi-

neering faculty, industry engineers and senior engineering students, on a short-cycle complete design focused on an urgent need of the developing world, e.g., water shortage and purification. Guest presenters, discussions and demonstrations will help inspire and inform the design teams.

Students will experience what it means to be an engineer. They will come to view their next four years — their courses, their professors, their classmates, people in need — in a very

different way, a transformational way, as they will see how individually they can transform the world, one person at a time. Faculty from all engineering disciplines will work side by side with industry experts as together they motivate and guide these students. They will also be transformed.

Engineering education is in crisis. A radical change in the status quo is needed. Changing culture — attitude and behavior — and instilling ownership in a vision is the most difficult challenge for any leader. Consensus — something in which no one believes and to which no one objects — is not a substitute for shared ownership. I think you first have to set a seemingly impossible goal. Amazing things happen when people claim responsibility for creating the impossible. In 1961, when President Kennedy called for putting a man on the moon, he didn't know how — but his vision was so compelling, his expectations of the American people so high — that they drove the moon shot well after he died.

What is happening at Marquette can happen everywhere, at all levels of education. Mechatronics engineers need to take a leadership role in addressing this national crisis in engineering preparedness. With our collective action the impossible can happen and engineering education will never be the same again.



BY KEVIN CRAIG

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**Engineering education is in crisis. Discover more ways you can take an active role in changing this trend:**

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