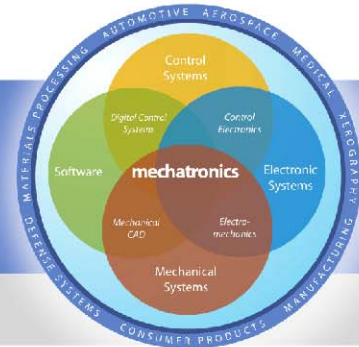# MECHATRONICS IN DESIGN

Crises Stimulate Opportunities

Crises in universities and industry must uncover new ways to collaborate.

TO SOLVE A PROBLEM one must first recognize that a problem exists. Universities and industry are in denial. Based on 30 years of teaching and industry experience, I say that not much has changed in this contentious relationship. The world now changes on a time scale measured in days. As a result, this situation is now at a crisis point. You would never know that by listening to academic and industry leaders. What I hear is a mix of doing the same old, same old or incremental change so we don't upset the silos and comfort zones that dominate these two worlds. Radical innovation is needed, along with visionary, selfless leaders who are not afraid to take on the challenge and take risks without fear of failure.

Do technological universities and industry have a common goal? I believe fundamentally they do: Solve the most urgent problems that face society to give people throughout the world the quality of life they all yearn for and nurture a planet that can sustain and enhance this quality of life indefinitely. Universities now need to do this through an integrated, multidisciplinary curriculum that recognizes this need and a delivery system that nurtures students to master the fundamental knowledge and the problem-solving process, along with the technological tools, to become catalysts for change.

Industry urgently needs to attain and retain a competitive advantage by organizing multidisciplinary teams to apply human-centered, model-based design techniques to these problems. Universities need to develop, and industry needs to hire, T2 engineers as envisioned by, for example, Stanford University, and IDEO and MAYA, two of the world's leading design firms.

Engineers need to have depth in an engineering discipline with multidisciplinary engineering breadth to communicate with engineers from other disciplines and lead them. The problems are multidisciplinary and a siloed approach to solving them will fail. But technological depth is not enough. Once engineers apply human-centered design to identify the real problem and model-based design to identify a technologically feasible solution, they then must determine if the proposed solution is viable and sustainable from a business point of view and usable from a managing complexity point of view. Technological depth and non-technical breadth are essential for innovation to happen.

This seems like a win-win situation for all involved: students, universities, practicing engineers, industry, society, and the planet. My view is that many academics think industry wants engineers who just use computer tools (training, not education), leave the mathematics and science back at the university, and do whatever it takes to make money. They also think that real problem-solving takes place with government funding that is substantial, long-term, with large overhead costs, that feeds the university reward system. Industry is now realizing that the design-build-test-break-fix approach to design leads to limited success and insight, and that the challenging problems they face can only be solved by embracing model-based design, that relies on mathematics and science, by engineers who are tool masters, not just tool users. Some of industry's problems demand

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short-term solutions with limited funding, but very often the short-term solutions uncover long-term fundamental issues that must also be addressed, usually with university collaboration. And this research is problem-driven. Universities need to demonstrate value to both their students and to industry to be the indispensable bridge between both that guarantees a bright future for all in the world. Pointing fingers and building barriers, like the all-too-common inflexible intellectual property rules and excessive overhead rates, exacerbates the problem.

Challenges are met and problems are solved by changing culture and instilling ownership. Consensus is not a substitute for shared ownership. Will the real leaders at universities and industry please step forward — the world cannot wait much longer. **DN**