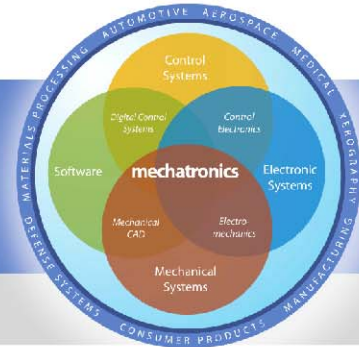# MECHATRONICS IN DESIGN

What Engineers Can Do

Machines Can't Do What Engineers Do So Well

ON FEBRUARY 3, 2014, David Brooks, a syndicated columnist, wrote an editorial that caught my eye immediately. The title "What Machines Can't Do" (**http://bit.ly/1g5zEFc**) would surely attract any engineer and, even before reading it, I wanted to complete the title with the words "Engineers Can Do So Well." I have written often over the years in this column that much of engineering is a commodity and that 21st-century engineers need to embrace human-centered, model-based design to innovate. Critical-thinking problem solvers are not a commodity and machines will never replace them. I then went on to read the article hoping that my views would be validated.

Brooks points out that, according to Erik Brynjolfsson and Andrew McAfee of MIT, we are in a second machine age. Parallel parking cars, picking stocks, diagnosing diseases, and beating human chess champions are just a few of the amazing tasks computers are performing today. As noted in this column many times over the years, information is a commodity, but discerning the knowledge in that information and applying it in the solution of a problem is not. So skills related to memory and following sets of rules, normally valued in school, are becoming much less so. Anyone involved in higher education has known straight-A students who are ineffective in understanding and applying memorized information. This deficiency is becoming much more transparent in this new age of machines.

What human traits will this new age reward? According to Brooks, curious enthusiasm is at the top of the list. Wanting to know and understand by sifting through huge amounts of information is essential. Engineers are always looking for insight and understanding. Curiosity defines them. A passion to solve the problem, even when science is lacking, has driven engineers for centuries. Extended time horizons and strategic discipline are

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the next attributes that are being rewarded. Engineers have the ability to look at the environmental, economic, and civil impacts of solutions, focus the solutions, and manage the resulting complexity through human-centered design, an ability computers have difficulty with. This new age rewards procedural architects. Engineers know the importance of following a process in solving a problem. This process must keep the team moving toward the goal, while still allowing the individual to be an individual. Consider the success of the unconventional product design

firms IDEO and MAYA and how they encourage the formation of teams with broad experience and expertise so as to see the problem from all points of view. Another skill computers fall short on is the ability to grasp the essence of an object, so

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combining existing things to create some new thing is a real challenge. Engineers do this routinely. We are experienced at identifying the essence of invention and combining existing inventions with new technology and new knowledge for innovation.

I think engineers are well positioned to be the leaders for innovation in this new age of machines. Human-centered design enables us to manage the vast amounts of information and the power of technology in solving the world's problems. Model-based design aids us in gaining insight and understanding that leads to new ideas and combinations of existing designs to create wondrous new devices and processes. Yes, engineers who embrace these attributes will lead. Complacency will lead to commodity. **DN**