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Theory and commercial software finding the balance in finite element instruction at the undergraduate level

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Like most accredited mechanical engineering programs, the undergraduate curriculum at California State University Chico Lincludes a required course in Finite Element Analysis (FEA). Historically, the primary focus of the class has been the underlying theory of the method and its formulation from fundamental governing equations with little to no instruction in commercial software designed specifically for the purpose. Students were taught the traditional theoretical methods (Stiffness, Galerkin, Virtual Work, Castigliano, etc.) and were given assignment problems with rigorous hand-work such as assembling stiffness matrices. They were taught computer based solution methods through non-specific computational software such as Excel and MATLAB*. Feedback from advisory boards, capstone project sponsors, senior exit surveys, and other evidence clearly indicated a problem with the curriculum's approach to finite element analysis. While program graduates were well versed in the theory of the method, there was strong evidence that they were not skilled its proper application via commercial FEA software, a very common task in the workplace. Observations included poorly posed problems, unnecessary computational rigor, meaningless results, or indeed the inability to obtain a solution at all. In response, the FEA course was redesigned to include basic instruction in the proper use of commercial FEA software while still maintaining sufficient theory for understanding the inherent assumptions and limitations of the method. Segments of theory-based discussion and traditional assignments are now followed with exploration of the same concepts in the context of commercial software. Emphasis is placed on its proper use, underlying assumptions, limitations, and validity of results.

Biography

Gregory K Watkins received a BS in Mechanical Engineering from North Carolina State University, a Master of Engineering Management from Old Dominion University, and a PhD in Mechanical Engineering from the University of North Carolina at Charlotte. He is a Professor in the Department of Mechanical and Mechatronic Engineering and Sustainable Manufacturing at California State University, Chico and is Coordinator of the Capstone Design Program. He previously taught in the Engineering Technology department at UNC Charlotte and the Engineering Technologies Division at Central Piedmont Community College. He also has nine years of industrial work experience and holds registration as a Professional Engineer.

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