Challenges in Designing Mechatronic Systems

Development of mechatronic products is traditionally carried out by several design experts from different design domains. Performing development of mechatronic products is thus greatly challenging. In order to tackle this, the critical challenges in mechatronics have to be well understood and well supported through applicable methods and tools. This paper aims at identifying the major challenges, by conducting a systematic and thorough survey of the most relevant research work in mechatronic design. Solutions proposed in literature are assessed and illustrated through a case study in order to investigate if the challenges can be handled appropriately by the methods, tools, and mindsets suggested by the mechatronic community. Using a real world mechatronics case, the paper identifies the areas where further research is required, by showing a clear connection between the actual problems faced during the design task, and the nature of the solutions currently available. From the results obtained from this research, one can conclude that although various attempts have been developed to support conceptual design of mechatronics, these attempts are still not sufficient to help in assessing the consequences of selecting between alternative conceptual solutions across multiple domains. We believe that a common language is essential in developing mechatronics, and should be evaluated based on: its capability to represent the desired views effectively, its potential to be understood by engineers from the various domains, and its effect on the efficiency of the development process.

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This paper is an extension to the article published in the proceedings of the ASME 2011 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC/CIE 2011. The literature study has been expanded from three to five years which revealed an additional 10 articles, thus adding 200 references to be included in the data processing. Furthermore, structured searches in seven relevant journals have been added to the literature study to identify mechatronic challenges. As a result, additional researchers and solutions have been identified and included.

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