Focused product family design based on the commonality and variety tradeoff

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Abstract

Today's manufacturers in various industries have utilised product families to satisfy their diverse customer needs while maintaining competitive cost structures. However, not so many manufacturers armed with current product family design approaches can fully benefit from the widely sought advantages of product family implementation. In this paper, the Focused Product Family Design Process (FPFDP) is proposed to help manufacturers utilise their limited engineering efforts to develop the achievable component-based product family design concepts in a focused and efficient way, using their own competitive focus and commonality-variety tradeoff analysis. This process uses a matrix design tool, the Attribute-Based Clustering Methodology (ABCM), to establish an efficient starting point in the design process, guiding manufacturers in generating component-based product family design concepts. This process also utilises a graphical evaluation tool, the Product Family Evaluation Graph (PFEG), to evaluate product family design concepts and determine the necessary direction of improvement for concepts - either increase the appropriate commonality or increase the appropriate variety. A set of indices - the Commonality Diversity Index (CDI) for commonality (CDI<sub align=right>C) and variety (CDI<sub align=right>V), the component-component dependency and the redesign difficulty - and redesign heuristics enable manufacturers to determine which components in each design concept are most in need of improvement to meet their design intent.

Keywords: Technical Journals; Design and Product Development; Materials and Manufacturing; Management Journals; Operational Management, Marketing and Services