Abstract

This thesis presents tools and methods for supporting the implementation of modularization principles in SMEs (small- and medium-sized enterprises). The tools and methods are to support the redesign of a portfolio of existing products by an improvement of the modular layout (architectures) of a new portfolio and the management of the product architectures.

Modularization has through the decades enabled companies to manage increased internal complexity due the demands for variety by lowering lead times and costs. Many of the initiatives found in the literature are from large enterprises or applied to large enterprises. SMEs also experience increasing demand for variety but may not have the same resources available for implementation modularization principles. SMEs constitute 56.4% of the value added in EU, and therefore this thesis is intended for supporting the use of modularization in these companies.

The contributions presented in this dissertation are paper-based. First is the DNA- method (deciding number of architectures) for deciding the total number of product architectures in the process of redesigning a portfolio of products. This method helped a medium-sized company reduce the total number of product architectures, increase commonality, maintain variable cost performance, and increase market coverage.

The second contribution is the MESA (mechanics, electronics, and software architecture) tool for mapping modular product architectures across the engineering domains of mechanics, electronics, and software. We applied the tool in two companies and it proved useful in visualizing cross-domain dependencies. Visualization that can improve planning of development activities and decrease cross-domain impacts through changes in new designs.

The third contribution is a methodology for utilizing and managing modular product architectures across information and design support systems: CAD (computer-aided design), PLM (product lifecycle management), ERP (enterprise resource planning), and configuration systems. The methodology, presented through the case study of a company, helped the company reduce the time conducting architectural changes and locating product documentation.

Overall, these three initiatives, which are all applied or observed in a medium-sized company, can support the implementation of modularization in medium-sized companies.