Developing product families based on architectures: Contribution to a theory of product families

The subject of this PhD thesis is development of product families based on architectures. Companies are introducing more and more product variants to fulfil the market demands. These new variants add complexity to many of the processes and systems in the companies. Reuse of standard designs (i.e. design entities) and re-use of the way new products are developed can simplify the processes and systems. Case studies show that reuse can lead to reduction of cost and time-to-market of new products.

One of the means for managing reuse of standard designs within product families are architectures. This research studies the phenomenon of product families that are developed based upon architectures. It is stated that an architecture describes the building principle of a product family and how the product family should evolve over time. This implies that an architecture should prescribe how standard designs are re-used in one or more products.

This research contributes with a vocabulary for product families. The vocabulary distinguishes among architecture, platform, standard design and design unit. The contribution is based on the artefact theories the Theory of technical systems and the Theory of domains. The vocabulary distinguishes between design entities, which are reused (standard designs) and those that are not reused (design units). Also, this research distinguishes between architecture and platform. An architecture is the building principle for product families. A platform is the physical and re-usable realisation of the architecture.

Two supporting tools are introduced in this research for modelling architectures and product families. The first tool is denoted Generic organ diagram. It aims at modelling the structures and interfaces of architectures. The second tool is denoted Product family master plan (PFMP). The PFMP aims at modelling product families and especially variety of product families.

The results of this thesis build on research literature and experiences from the industrial partners. Extensive verifications of the theory contributions, models and tools have been carried out in industrial projects. The primary industrial partner has been Bang & Olufsen, but other industrial applications have been carried out at Vestas, Alfa Laval, LEGO and YORK Refrigeration.