PhD Proposal 2016

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Title: **Development of a Knowledge Based Product Design Method for Small Batch Production Context**
Scientific field (*): Automation and Robotics, System Engineering, Industrial Engineering
Key words: Knowledge Capitalization, Knowledge Reuse, Product Property, Optimal Design

(*) *: Chemical engineering, Computer Science, Image and data processing, applied mathematics, Electrical engineering, Automation and Robotics, System Engineering, Industrial Engineering, Fluid Mechanics, Aerodynamics, Acoustics, Combustion, Material Science, Optics, Electronics, Nano technology, Micro-system, Bioscience, Solid mechanics, Surface Science, Civil engineering.*

Details for the subject:

Background, Context:

As indicated by the product market, fast, low cost and optimal product design and development methods are demanded to provide highly customized product with short life cycle to meet diverse and specific client requirements on changing product characteristics. However, traditional design methods and tools are usually developed for dealing with product design in mass production or low level mass customization context. For example, the modular based design methods and tools. In small batch production context or even one-per-product production context, the current methods and tools could hardly meet the cost and time requirement as well as the product complexity. Since product design is very knowledge intensive, the reuse of knowledge would improve the efficiency and reliability. Hence, to meet the design requirements from the new product context, there is some possibility of developing knowledge based product design tools to serve this new context. The expected knowledge based design method and its allied tools should cover a whole product development process, from design to manufacturing, in the horizontal direction and should connect three different levels of complexity of product design, micro material level, macro product level and global functional level in the vertical sense. Diverse knowledge modules should be equipped to support the designers' decision making in different design stages. This would give designers a full view and sufficient knowledge to conceive tailored product characteristics with both local and global optimality in a quick way.

Research subject, work plan:

This research will investigate the development of a knowledge based design method and its allied decision making tools to support frugal product design so as to deal with the product development problem in the small batch production context. The preliminary general work plan for the PhD candidate is given as follows:

1. Investigate current product design methods, especially customized or personalized product design methods and tools;
2. Investigate knowledge based tools and methods in product development;
3. Propose a new knowledge based product design method for small batch product context;
4. Investigate the knowledge capitalization and reuse for proposed design method;
5. Develop a prototype of knowledge based design evaluation and guiding tool;
6. Conduct real case study for the proposed methods and allied tools.

The expected results of the proposed research are several scientific papers with high originality and quality for first-class peer-reviewed journals and international conferences in design and production domains. And, a prototype of design evaluation and guiding tool should be developed.

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