Implementation of Concurrent Redesign & Manufacture procedure for an automotive component

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Abstract

With the development of Global market, it has become a major challenge for most of the manufacturing enterprises around the world to optimize their production strategies because of the demand for “The better quality product with shorter lead time and lower life cycle cost”. In order to meet these requirements, many enterprises face a critical need for advanced system engineering for Engineering. The changeover from the Traditional method of manufacturing to Concurrent method of manufacturing is one of the solutions. The front fork of the leading two wheeler was chosen for implementing the Redesign in Concurrent Engineering (CE). The main objective is to reduce the Manufacturing lead time and the cost of the product. The Co-ordinates of the already existing Front fork of a leading 2 wheeler was done using Co-ordinate Measuring Machine (CMM) and the model of the fork was obtained in CATIA, which is a Reverse Engineering concept. The model of the fork was stored in a database, such that it can be retrieved anytime in future. Slight variations in the design in future can also accommodated. Parts with similar design attributes can be grouped such that the Group Technology is achieved. The machining simulation was done using CATIA. The machining simulation can also be used to group the components having similar manufacturing attributes by storing the machining codes generated, in the database. The buckling analysis of the component was done using ANSYS for compressed loading condition. As the number of iterations in the Redesign-Concurrent method increased, both time and the cost reduced drastically.

Keywords: Concurrent Engineering; Redesign; Reverse Engineering; Group Technology; CATIA

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1.0 Introduction

Concurrent Engineering (CE) is also known as simultaneous engineering. In which the Product development has changed from the traditional serial process of design followed by manufacture to a more organized concurrent process where design and manufacture are considered at a very early stage of design the concept of concurrent engineering is no longer new and yet it is still applicable and relevant in today’s manufacturing environment. With the development of global economic market, it has become a major challenge for most manufacturing enterprises all around the world to optimize their production strategies because of the demand for the better quality product with shorter lead time and lower life cycle cost. In order to meet this requirement, many enterprises face a critical need for advanced system engineering tools and methods. One solution to improve competitiveness is to change from a traditional design and development process to a concurrent engineering process.

In traditional design and development process such a serial engineering environment it has been known that different stages such as product design, process, review and manufacturing are conducted separately and sequentially therefore if some problem arises during design review this may cause the need for product to be redesign and this redesign activity adds overall time to market for the product. This factor weakens the competitiveness of product. The concurrent engineering is a systematic approach to the integrated design for manufacturability, testability, quality and serviceability equally and in parallel with product design the concurrent engineering environment integrates the expertise from the various engineering discipline during the actual design stage. With proper forethought many of the problem that can be occurred under the serial engineering process can be completely prevented the elimination of design iteration reduces product development cost and shorten time to market for new product. Kayas et.al [1] analyzed the challenges of product design and development in Concurrent Engineering. The inheritance of risks between different phases were modeled and quantified by Concurrent Engineering process which are impossible by Traditional Project Management Techniques. The also released a user-interactive, unique and dynamic management software for Concurrent Engineering which was commercialized successfully. Xue and Yang [2] designed a database representation model and introduced it for supporting various life cycle aspects in concurrent engineering. A Web-based system architecture was proposed to model distributed design database and allow team-members for different product development life-cycle aspects at different locations to access the design database. This newly introduced approach provided the foundation for developing the next generation CAD systems with concurrent engineering functions. Fredric Demoly [3] enabled Geometric skeleton computation for concurrent product engineering and assembly sequence planning. The objective of their research was to integrate assembly process engineering information and knowledge in the early phase of the product development process in a top-down and proactive manner, in order to provide a geometry skeleton-based assembly for Engineers. Edwards [4] designed strategic ideas for manufacture and assembly based on priorities of concurrent engineering. He investigated the strategic application of materials and manufacturing process information during the design process. The basics were analyzed for the application of quantifiable data. A discussion was also made on designs of new process and advancements of old existing product methods. Liu et.al [5] simulated an FE for concurrent design and manufacture of automotive sheet-metal parts. It can be considered as an effectiveness of enabling concurrent design and manufacture, particularly for those components that were formed by plastic deformation. They studied it for three parts- the deep drawing of an oil pan, and the stamping of outer and inner panels of an automobile.

Tsai et.al [6] applied concurrent engineering in the installation of foam fire extinguishing piping system. They implemented the idea of concurrent engineering in construction industry to make an improvement in the construction process. They used Delphi questionnaire analysis to establish a framework for piping installation. Sapuan [7] developed a knowledge based system for materials selection in mechanical engineering design. He indicated the importance of knowledge-based system in the context of concurrent engineering. The selection of material data bases and material selection packages were also studied. Abdelraoof Mayyas et.al[8] developed the use of quality function deployment and analytical hierarchy process for material selection of body in white. They presented a manuscript discussing the usage of multi-attribute decision making tools to assist in material selection for vehicular structures. The main analysis was done to depict the effectiveness of concurrent engineering process.
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