Bansilal Ramnath Agarwal Charitable Trust's

VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 411037

666, Upper Indiranagar , Bibwewadi, Pune 411037

Department Of Mechanical Engineering

Subject: Mechanical System Design

Home Assignment: VIRTUAL TESTING OF DESIGN

Group No: 5 Batch: D1

Group Members: 1)Soham Phadtare (1)
                 2)Prathmesh Rajput (11)
                 3)Kiran Ranmale (15)
                 4)Mayur Rathod (17)
                 5)Niraj Raut (20)
                 6)Prasad Ruikar (24)

Guide: Prof.Moreshwar Khodke Sir

Introduction

Manufacturing systems play a very important role in the future so, from observing product models we are getting that product data and from that data computer aided technologies enabled us to smooth data transfer.Simulations in the virtual world and exchange of real time product or design data are the benefits for today's manufacturing business industry.

There are different applications of virtual engineering technologies. We can consider virtual prototyping on a representative model. Today's engineering world is highly interested in implementing virtual prototyping in their design and manufacturing process. Virtual testing of design provides cost effective solutions from which we are experimenting with different models with different conditions.

Nowadays, there is strong competition in the market. Many of the companies focused on competitive factors such as better performance, short time to market and competitive pricing. These competitive factors play an important role when they introduce new product brands in the market.

The traditional computer-aided design (CAD) and computer-aided manufacturing (CAM) approaches are now being addressed through computer-aided engineering (CAE) integrating platforms, which allow the evaluation and improvement of the product at the system level and not separately on its parts or subsystems, such an approach being reflected in increasingly efficient and competitive products.

Software Platform for Virtual Prototyping

There are three basic software solutions in mechanical system provided by virtual prototyping platform.This are :

1. Computer Aided Design
2. MultiBody System
3. Finite Element Analysis
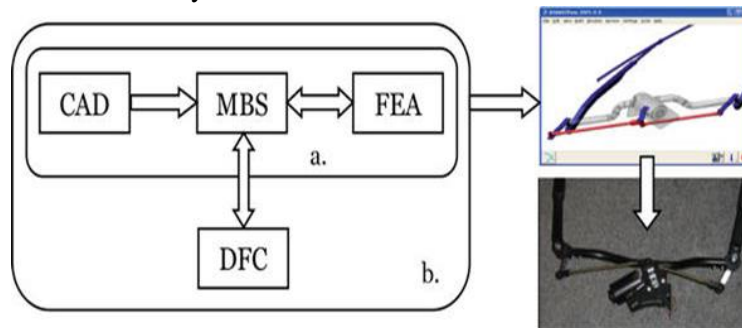
Source: Wikipedia

With the help of cad software the different geometrical 3D model of mechanical systems is developed. The purpose behind that is to determine the mass and inertial properties of bodies, this is the first phase. In the next phase this 3D model was transferred to multibody system software. In this phase we are analysing and optimizing the behaviour of mechanical systems. Such as kinematics, dynamics and static. But the data transfer from CAD to MBS is not an easy task because we are using different geometry file formats. Such as STEP, IGES, etc. The based on the results observed in MBS software now transfer to finite element analysis software.

Virtual Prototyping Process

There are five foundations of Virtual prototyping process, they are as follows:
1. Modeling
2. Analysis
3. Validation
4. Refining
5. Optimization

During the modeling stage different mechanical components are created by using software solutions. The output of this modeling stage is analysed, analysed means it is simulated and tested. From this analysis we can determine the behaviour of the system.

From the results obtained through simulation, we are considering the results with experimental results. And these experimental results obtained from physical prototyping. If this observing and experimental results are the same or approx. Then only we validate the virtual model. If results obtained through the simulation do not match with experimental results then we consider it as invalid virtual model.

The last step of the virtual prototyping process will be the optimization, which aims to determine the optimal design of mechanical systems, here we use word optimization for functionality, efficiency and how economical the product is. These are determining factors in this last stage of optimization.

Refining plays an important role where we are getting results of invalied virtual models in the validation stage. The refining stage must be accomplished with the purpose to improve the fidelity of the virtual model by reference to the physical one. The refined virtual model is then analyzed by simulation in a virtual environment, followed by a new validation.
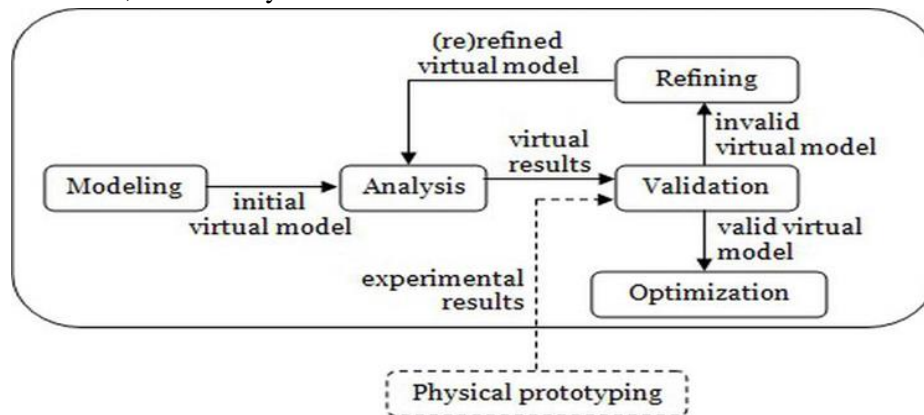
Source: Wikipedia

Advantages:

Shorter time to market:

The traditional product development process involves building a physical prototype and passing it to the lab for testing. This process takes a longer time. But using virtual prototyping design software we are discarding these unnecessary loops. Due to this we save both time and cost of development as a result.

High Design Quality:

Performing engineering calculations using a spreadsheet and then building and testing a prototype can miss some fundamental errors. These errors might result in design flaws that will not become apparent before the product gets manufactured and distributed, resulting in warranty costs and even recalls.

More competitive product:

Virtual prototyping, on the other hand is far less costly and time-consuming and allows engineers to freely experiment with innovative designs and scenarios, developing a highly competitive product in terms of functionality, performance and exterior design.

Disadvantages:

Developer misunderstanding of user objectives:

For every project to be successful, developers and customers must be on the same page and share the same project objectives. If customers require all proposed features of a prototype be included in the final product, this can lead to team and mission conflicts.

Excessive Development Time:

Remember, prototypes are by nature designed to be developed quickly. If a developer spends too much time developing a complex prototype, the project can run into roadblocks especially if there are disagreements over prototype details and run over both time and cost budgets.

Conclusion:

The use of virtual prototyping software platforms in the analysis and optimization of the mechanical systems offers important benefits, which focus on reducing the costs, as well as the design and development time. While increasing the quality in terms of operational performance of product by using virtual prototype design we have simulated any types of materials model.

-Thank You -