VIRTUAL MECHANISMS

P. D. Mehta[1] , Dr. D. S. Ingole[2]

[1]Senior Lecturer in Mech. Engg., Govt. Polytechnic, Amravati (M.S.) 444603
[2]Head of Dept., (Prod Engg.), College of Engineering, Badnera, Dist: Amravati (MS.) 444 701

---***---

Abstract:- *Engineering design and drafting forms the core of engineering profession & computer aided design and drafting (CAD) has been acknowledged as the key to improve productivity and the best approach for meeting the recent critical design requirements. The CAD speeds up the design process, increases productivity, innovation & creativity of designs. One of the fundamental activities in which engineers are involved is model building. The process of model building is a way to present knowledge and to explore alternative solutions. The present work consists of the modeling and development of visual application software for the various engineering mechanisms, widely used in most of the industries.*

Key words: virtual, mechanisms, CAD, simulation, animation, design process, computer applications.

Introduction

With today's growing advancement, computer proves to be a powerful tool to engineering needs. They are extensively used to plan, control, analyze & modify various problems. These would otherwise be very difficult tasks manually & time lagging.

In engineering discipline, the computers are extensively used for both design and drafting purposes. Among the several fundamental reasons for implementing CAD system, productivity improvement, improvement in quality of design, communication and data base generation for manufacturing constitutes the major functions.

Graphical representation is always convenient from the view point of understanding. It is essential that the engineer makes use of the graphical faculties available in software packages. Geometric modeling constitutes the most important and complex part of the graphic software package. The use of CAD/CAM technology is reducing product development time, since all the functions could now be accomplished by one individual working at single computer terminal. Several engineers could perform all these functions at the same time by using networked computers.

Computer Application in Design Process

The general design process begins with an identified need that can be satisfied by the product of engineering effort, followed by the clear cut problem definition. After the problem has been defined, viable solutions need to be identified from which the optimum approach can be selected. Assessment of the feasibility of selected concept is accomplished as a part of conceptualization task.

The process further involves a combination of synthesis & analysis. Synthesis means to combine the elements of an object into a complex whole. At the beginning of the process, when possible solutions being sort & identified, reasoning proceeds directly from the statement of need and principles established or assumed to be a possible answer. Analysis begins almost immediately thereafter and to analyze means to separate whole into its constituent elements. In the design process synthesis and analysis are inter related & continuous ongoing process. The further steps in general design process are evaluation & presentation. Evaluation is concerned with measuring the design against the specification established in the problem definition phase. Presentation includes the documentation of design by means of drawing material specification, assembly lists & so on.

The various design related tasks which are performed by a modem CAD system may be grouped into the various functional areas like, geometric modeling, engineering analysis, design review & evaluation automated drafting, etc. Modern CAD systems are based on interactive computer graphics in which the computer is employed to create, transform & display data in the form of pictures or symbols. These pictures can be modified, enlarged, reduce in size, move to another location on screen, rotated & transformed. Through modeling engineers expand and enrich their vision, exercise their sensibilities, formulate unique and personal interpretation, process and optimize a large number of alternative solutions, originate

innovations and enhance their understanding of physical problems. Moreover, in a computerized environment, the information a designer generates can form the basic unit to be accessed by a number of others. It is anticipated that new design and manufacturing algorithms and capabilities will become available; various applications will be supported by better and faster computing hardware and efficient networking and communication software.

Engineering Mechanisms and Their Applications

The study of mechanisms involves their analysis and synthesis. Analysis is study of their motion & forces concerning different parts of existing mechanisms while synthesis involves design of different parts. In a mechanism various parts are so proportioned & related that the motion of one imparts requisite motions to others & parts are able to withstand the forces impressed upon them.

If a number of bodies are assembled in such a way that the motion of one causes the constraint & predictable motions to other, is known as 'mechanism'. The mechanism transmits & modifies a motion. According to the number of general restraints, mechanisms can be classified into different orders, like, zero order, first order and up to fifth order. The sixth order mechanism cannot exist, since all the lines become stationary & no movement is possible.

The various industrial applications can be derived from the combinations of constraining links and inversions of these mechanisms. The efforts have been made to model and represent the most commonly used mechanisms with the help of popular graphic software as represented in **Fig.1** [**Wireframe representation of Engineering Mechanics**]. The mechanisms under study are further visually stimulated.
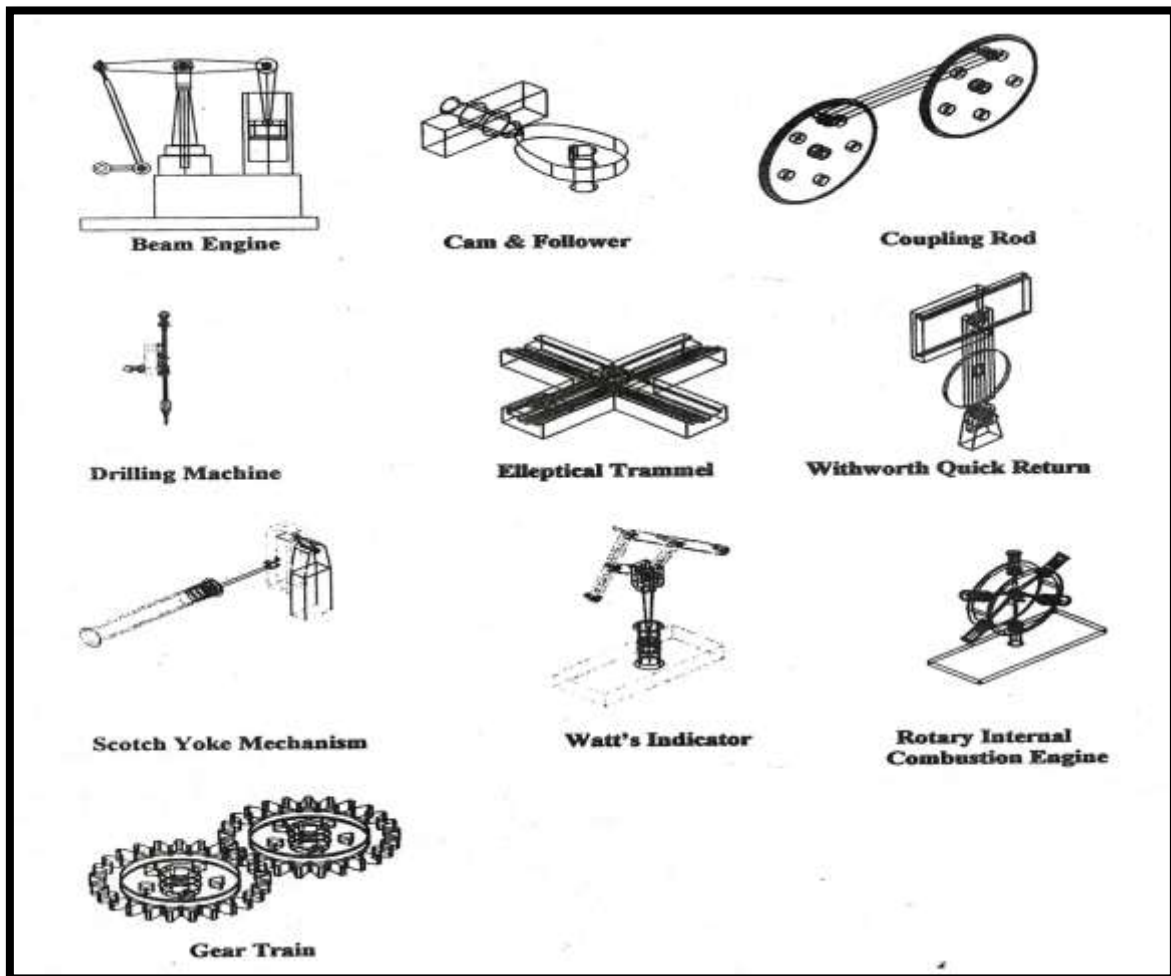

fig.1: **Wireframe representation of Engineering Mechanisms**.

Virtual Mechanisms

Almost every factory floor now uses a general purpose or a custom built simulator for decision making and analysis. Discrete event simulation modeling offers the scope for building and analyzing detailed models of the industrial mechanisms.

Simulation of virtual mechanisms involve the development of a simulation model, coding the model into simulation program, validating the simulation model, debugging the simulation program, running the simulation for a wide variety of random inputs and conducting the statistical output analysis for obtaining Performance measures.

Conclusion:

In The present work, the most commonly used & basic mechanisms are modeled with the help of commercially available graphics package. The development of application software gives the wire frame representation of mechanisms which is the assemblage of the various links with appropriate positioning and orientations. The objects are then animated in order to simulate them visually. This is the 3D representation of the working of various mechanisms in the virtual environment.

References:

1. Mikell P. Groover, Emory W. Zimmer; CAD-CAM; Prentice Hall of India Pvt. Ltd.2003.
2. Anthony Potts, David H. Friedel, Anthony Stock; 3D-Studio Max; Comdex Publishers.
3. Ibrahim Zeid ; CAD-CAM Theory And Practice; Tata McGraw-Hill.
4. Dr. Sadhu Singh; Computer Aided Design And Manufacturing; Khanna Publishers