UNIT V
ACTUATORS AND MECHATRONIC SYSTEM DESIGN

Design process

- stages of design process
- Traditional and Mechatronics design concepts

5.5 Stages in Designing Mechatronics Systems

☞ [AU : May-2013, 2014, 2 Marks]

The design process consists of the following stages :

Stage I : Need for design

- The design process begins with a need. Needs usually arise from dissatisfaction with existing situation.
- Needs may come from inputs of operating or service personal or from customer through sales or marketing representatives.
- They may be to reduce cost, increase reliability or performance or just change because of public has become bored with the product.

Stage 2 : Analysis of problem

- Probably the most critical step in design process is the analysis of the problem i.e., to find out the true nature of the problem.

- The true problem is riot always what it seems to be at the first glance.
- Its importance is often over looked because this stage requires such small part of the total time to relate the final design.
- It is advantageous to define the problem as broadly possible.
- If the problem is not accurately defined, it will lead to waste of time on designs and will not fulfil the need.

Stage 3 : Preparation of specification

- The design must meet the required performance specifications.
- Therefore, specification of the requirements can be prepared.
- This will state the problem definition of special technical terms, any constraints placed on the solution, and the criteria that will be used to evaluate the design. Problem statement includes all the functions required of the design, together with any desirable features.

Stage 4 : Generation of possible solution

- This stage is often called as conceptualisation stage.
- The conceptualisation step is to determine the elements, mechanisms, materials, process of configuration that in some combination or other result in a design that satisfies the need.
- This is the key step for employing inventiveness and creativity.
- A vital aspect of this step is synthesis

Stage 5 Synthesis

- Synthesis is the process of taking elements of the concept and arranging them in the proper order, sized and dimensioned in the proper way.
- Outline solutions are prepared for various possible models which are worked out in sufficient details to indicate the means of obtaining each of the required functions.
- This stage involves a thorough analysis of the design.
- The evaluation stage involves detailed calculation, often computer calculation of the performance of the design by using an analytical model.
- The various solutions obtained in stage 4 are analysed and the most suitable one is selected.

Stage 6 : Production of detailed design

- The detail of selected design has to be worked out.
- It might have required the extensive simulated service testing of an experimental model or a full size prototype in order to determine the optimum details of design.

5.6 Traditional and Mechatronics Designs

- Engineering design is a complex process which involves interaction between many skills and discipline.
- In traditional design, the components are designed through mechanical, hydraulic or pneumatic components and principles.
- But in mechatronics approach, mechanical, electronics, computer technology and control engineering principles are included to design a system.
- For example design of weighing scale might be considered only in terms of the compression of springs and a mechanism used to convert the motion of spring into rotation of shaft and hence movements of a pointer across a scale.
- In this design measurement of weight is depended on the position of weight on the scale.
- If we want to overcome foresaid problem, other possibilities can be considered.
- In mechatronics design, the spring might be replaced by load cells with strain gauges and output from them used with a microprocessor to provide a digital readout of the weight on an LED display.

- This scale might be mechanically simpler, involving fewer components and moving parts. But the software is somewhat complex.
- Similarly the traditional design of the temperature control for a central AC system involves a bimetallic thermostat in a closed loop control system.
- The basic principle behind this system is that the bending of the bimetallic strip changes as the temperature change and is used to operate an ON/OFF switch for the temperature control of the AC system.
- The same system can be modified by mechatronics approach.

- This system uses a microprocessor controlled thermo couple as the sensor.
- Such a system has may advantages over traditional system.
- The bimetallic thermostat is less sensitive compared to the thermodiode.
- Therefore the temperature is not accurately controlled.
- Also it is not suitable for having different temperature at different time of the day because it is very difficult to achieve.
- But the microprocessor controlled thermodiode system can overcome fore said difficulties and is giving precision and programmed control.
- This system is much more flexible.
- This improvement in flexibility is a common characteristic of the mechatronics system when compared with traditional system.

5.6.1 Comparison between Traditional and Mechatronics Design

☞ [AU : May 2013, Dec. 2013, 2014, May 2014, 2 Marks]

Sr. no.	Traditional design	Mechatronics design
1.	It is baseed on traditional system such as mechanical, hydraulic and pneumatic	It based on mechanical, electronics, computer technology and control engineering
2.	Less flexible	More flexible
3.	Less accurate	More accurate
4.	More complicate mechanism in design.	Less complicate mechanism design
5.	It involves more components and moving parts.	It involves fewer compounds and moving parts.

THANK YOU


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