PRODUCT LIFE CYCLE MANAGEMENT
(19MEE404)

TOPIC :DIGITAL MANUFACTURING

DIGITAL MAUFUCTURING:

Digital manufacturing is an integrated approach to manufacturing that is centered around a computer system. The transition to digital manufacturing has become more popular with the rise in the quantity and quality of computer systems in manufacturing plants. As more automated tools have become used in manufacturing plants it has become necessary to model, simulate, and analyze all of the machines, tooling, and input materials in order to optimize the manufacturing process. Overall, digital manufacturing can be seen sharing the same goals as computer-integrated manufacturing (CIM), flexible manufacturing, lean manufacturing, and design for manufacturability (DFM). The main difference is that digital manufacturing was evolved for use in the computerized world.

Simulation:

Simulation can be used to model and test a system's behavior. Simulation also provides engineers with a tool for inexpensive, fast, and secure analysis to test how changes in a system can affect the performance of that system.

These models can be classified into the following:

•Static - System of equations at a point in time

•Dynamic - System of equations that incorporate time as a variable

•Continuous - Dynamic model where time passes linearly

•Discrete - Dynamic model where time is separated into chunks

•Deterministic - Models where a unique solution is generated per a given input

•Stochastic - Models where a solution is generated utilizing probabilistic parameters

Analysis:

- Digital manufacturing systems often incorporate optimization capabilities to reduce time, cost, and improve the efficiency of most processes. These systems improve optimization of floor schedules, production planning, and decision making. The system analyzes feedback from production, such as deviations or problems in the manufacturing system, and generates solutions for handling them.
- In addition, many technologies analyze data from simulations in order to calculate a design that is optimal before it is even built.
- Debate continues on the impact of such systems on the manufacturing workforce. Econometric models have found that each newly installed robot displaces 1.6 manufacturing workers on average. Those models also have forecasted that by 2030 as many as 20 million additional manufacturing jobs worldwide could be displaced due to robotization.

Tooling and processes:

There are many different tooling processes that digital manufacturing utilizes. However, every digital manufacturing process involves the use of computerized numerical controlled machines (CNC). This technology is crucial in digital manufacturing as it not only enables mass production and flexibility, but it also provides a link between a CAD model and production.The two primary categories of CNC tooling are additive and subtractive. Major strides in additive manufacturing have come about recently and are at the forefront of digital manufacturing. These processes allow machines to address every element of a part no matter the complexity of its shape

Examples of additive tooling and processes:

•Stereolithography - In this process, solid parts are formed by solidifying layers of a photopolymer with ultraviolet light. There is a wide range of acrylics and epoxies that are used in this process.

•Ink-Jet Processing - Although the most widely used ink-jet process is used for printing on paper, there are many that are applied in engineering. This process involves a printhead depositing layers of liquid material onto a filler powder in the shape of the desired object. After the powder is saturated, a fresh new layer of powder is added continually until the object is built. Another less known material drop deposition process use a build and support material to produce a 3D model. The build material is Thermoplastic and the support material is wax. The wax is melted away after the layered model is printed. Another similar technique uses (DBM) Droplet based manufacturing to build Thermoplastic models without support with 5 axis drop positioning

Examples of subtractive tooling and processes:

•Water Jet Cutting - A water jet cutter is a CNC tool that uses a high pressure stream of water, often mixed with an abrasive material, to cut shapes or patterns out of many types of materials.

•Milling - A CNC mill uses a rotational cutting tool to remove material from a piece of stock. Milling can be performed on most metals, many plastics, and all types of wood.

•Lathe - A CNC lathe removes material by rotating the work-piece while a stationary cutting tool is brought into contact with the material.

THANK YOU