



MANUFACTURING AUTOMATION

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PRE-REQUISITES : Basic Engineering Courses

INTENDED AUDIENCE : Mechanical Engineering, Metallurgy, Aerospace Engineering, Production Engineering

INDUSTRIES APPLICABLE TO : All Manufacturing industries, Machine tool manufacturing industries, Automobile Industries and aeronautical assembly industries

COURSE OUTLINE :

The course will basically deal with the following topics: Introduction: Definition; Types of automation; Reasons for automating; Automation strategies. Detroit type automation : Automated flow lines: types and their selection; Methods of workpart transport; Transfer mechanisms; Controlling of automated flow lines. Analysis of automated flow lines: System aspects of designing and running the line; Average production time and production rate; Line efficiency; Analysis of transfer lines without storage – upper bound and lower bound approach; Partial automation. Automated assembly systems: Historical developments of the assembly process; Choice of assembly methods; Design for automated assembly; Transfer systems; Vibratory bowl feeders – its analysis; Non-vibratory feeders and their analysis; Analysis and design of part orienting devices, feed tracks and part placing mechanisms. Orientation of parts in automatic assembly: In-Bowl and Out-of-Bowl Toolings; Typical Orienting Systems: Wiper Blade, Pressure Break, slot in the track; Analysis of Part Orienting Systems; Examples of Out-of-Bowl Toolings; Feed Tracks: Analysis of Horizontal Delivery Feed Track; “ON-OFF” Sensors; Reliability of Feeding.

ABOUT INSTRUCTOR :

Prof. Sounak Kumar Choudhury have completed my Ph.D. in Mechanical Engineering from Moscow, Russia in 1985 followed by post-doctoral at the same university till 1986. From 1986 I am involved in teaching and research in the Mechanical Engineering Department of Indian Institute of Technology Kanpur. My areas of specialization are conventional and non-conventional machining, automatic control, hydraulic control, machine tools and manufacturing automation.

COURSE PLAN :

Week 1 : Definition; Discussion on Pros and Cons of Automation; Benefits of Automation; Types of automation: Fixed automation, programmable automation, and Flexible automation- Typical Features and examples; Reasons for automating; Automation strategies; Automated flow lines: the objectives of the use of flow line automation; General forms of Work Flow – criteria for selection; Methods of work part transport: Continuous, intermittent and asynchronous: types and their selection; Transfer Mechanisms; Examples of transfer mechanisms for linear travel and rotary transfer mechanisms; Buffer Storage;

Week 2 : Flow line Performance Analysis: Average production time and production rate; Mean time per cycle when machine breakdown occurs; Flow line Performance Analysis: Line efficiency; Cost per item produced; Partial automation: Reasons for using, Advantages and drawbacks; Production and Throughput: Examples; Effect of machine Jamming; Component Quality Control; Choice of assembly methods: Cost, Production Rate, Availability of Labour, and Market Life of the Product; Advantages of Automatic Assembly; Design for automated assembly; Components of automatic Assembly Machines;

Week 3 : Transfer systems; Assembly Machines: In-Line, Rotary; Continuous and Intermittent Transfer; Indexing Machines: Factors affecting the choice; Various Indexing Mechanisms; Vibratory bowl feeders: Mechanics of Vibratory Conveying - its analysis; Effect of Frequency, Track Acceleration and Vibration Angle; Effect of Track Angle and Coefficient of Friction; Summary of Bowl Feeder Design; Spiral Elevators; General Requirements of Part Feeders; Non-vibratory feeders : Reciprocating Tube Hopper Feeder – its analysis; General Features. Centerboard Hopper Feeder: Analysis: Maximum Track Inclination, Total Cycle Time, Mean Feed Rate;

Week 4 : Reciprocating Tube Hopper Feeder: Principle of Operation; External Gate Hopper Feeder: Its Analysis: Maximum Peripheral Velocity, Mean Feed rate; Rotary Disk Feeder: Indexing and Rotary Disk Feeder with continuous drive and their analysis: Load sensitivity, Efficiency and Mean Feed Rate; Orientation of Parts in Automatic Assembly: In-Bowl and Out-of-Bowl Tooling's; Typical Orienting Systems: Wiper Blade, Pressure Break, slot in the track; Analysis of Part Orienting Systems; Examples of Out-of-Bowl Toolings; Feed Tracks: Analysis of Horizontal Delivery Feed Track; “ON-OFF” Sensors; Reliability of Feeding.