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Recent Developments in Production Research

ANIL MITAL (Editor)
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This is a collection of 111 refereed papers selected from the 450 presented at the Ninth International Conference on Production Research, held during August 1987 in Cincinnati. Most of these papers concentrate on the new technologies, such as flexible manufacturing systems, artificial intelligence, expert and knowledge-based systems, computer-aided design and manufacturing, computer-integrated manufacturing, just-in-time, robotics, etc. and their contribution in solving the design, implementation and control problems of manufacturing-related activities. The papers are divided into 21 sections.

Section 1 is made up of a solitary paper analysing the performance of a gain-sharing system called IMPROSHARE, the most recent of the three commonly employed organizational incentive systems by companies seeking to boost their productivity.

The three papers contained in section 2 deal with the instrumentation design problems for various applications, such as fixture design and testing the properties of materials.

There are seven papers in the third section, which primarily address the metal-cutting or metal-removal activity in manufacturing. This section will be of interest mainly to metallurgists or people engaged in similar activities.

Tool wear and tool life is the subject of the next section, in which there are four papers. Here, the use of the pattern-recognition technology in tool-wear determination, the relationship between tool life and tool wear and the use of the surface texture for machine-tools monitoring are investigated.

The eight papers in section 5 discuss the issues of inspection and quality in manufacturing. This is a section for the quality controller, where techniques like integrated inspection, sampling, mathematical morphology, spatial spectral analysis, attribute control charts and double screening procedure are considered.

Section 6 is a collection of four papers on inventory systems. Integrated production-inventory systems are analysed in the first two papers; the third paper considers a multi-product inventory system with capacity restrictions; and the final paper attacks the combined problem of scheduling and controlling the inventory of fuel using network-programming principles.

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There are five papers on production planning and control in the seventh section. The first two papers address the problems of hierarchical production planning; the third is on multi-stage assembly systems; the fourth considers a control-theory approach to production smoothing; and the fifth paper discusses the limitations of a CAN-Q model for design and evaluation.

Section 8 is a collection of eight papers on production scheduling problems, where various approaches to and aspects of scheduling, such as real-time scheduling, hierarchical scheduling, job release rules, group scheduling and dynamic dispatches, are discussed. A number of heuristic and exact algorithms are also described.

Seven papers on facilities location and layout are included in section 9. In this section, there is an application of fuzzy set theory to facility location, a survey of computerized facilities layout software, a microcomputer-based program for facilities design, an interactive computer graphics approach to facilities layout, a design methodology for intelligent production facilities and an approach for evaluating the flexibility of a layout.

Section 10 has four papers on warehousing and storage systems, which discuss storage policies in automated warehousing, automated storage systems with a knowledge base, use of artificial intelligence in automated storage and retrieval system control, and three-dimensional warehousing systems, respectively.

Three papers on assembly-line balancing problems make section 11. A heuristic procedure for solving a dual criteria problem is given in the first paper. The next paper presents an extended heuristic for single- or mixed-model enlarged station balancing. The problem of assigning models to mixed-model lines is analyzed in the final paper of the section.

In section 12, there are 10 papers on various modeling and optimization methods applied to solve a variety of production research problems. There are three papers on economic models, three on mathematical models and four on optimization. The techniques here vary from the more traditional ones to the most recent ones.

Section 13 has three papers on numerically controlled systems. They describe a CAD/CAM data-integration method, use of real-line cutting-force management to improve contour accuracy of NC/CNC machine tools and a critical angles algorithm to convert the cutter centre line data into real shape details.

There are four papers on group technology in the fourteenth section, the first two of which describe a classification and coding system for the electronics and the dye casting industry respectively. The other two papers present a similarity-based procedure for machine-cells formulation and a heuristic for mean flow-time minimization respectively.

Section 15 has three papers on CAD/CAM, where the first is a survey of part-feature recognition systems, the next paper describes a process-planning and estimating system for a jobbing foundry, and the third paper outlines an approach for designing cathodes for electrochemical drilling.

The next section is also made up of three papers, which are on industrial and assembly automation and include a case study describing a coffee-maker design suitable for automatic assembly.

Section 17, on flexible manufacturing systems, contains seven papers. Here, problems of operational control, part selection, performance measuring and maximizing output rate are considered. There is also a description of a simulator for rapidly modelling a complex FM system.

Section 18 focuses on the use of industrial robots in manufacturing. Ten papers are included. The pros and cons of the use of robots are discussed where case studies are also included. Other contributions deal with various installation, operational and control problems of robot workstations.

Six papers on just-in-time systems are included in section 19. The main topics addressed here include an 11-stage implementation plan, Kanban systems, a simulation technique to determine lot sizes and material-flow techniques in a job-shop set-up.

Section 20 is on the subject of design and control of material flow in computer-integrated manufacturing, in which six papers are included. Problems of robot palletizing, selecting unit load sizes, devising supervisory controllers, managing the flow of work and of cell control are investigated for large and complex systems.

In the last section, which is on artificial intelligence and expert systems, there are five papers. Various knowledge-based and artificial-intelligence-driven systems are described in this section.