

Stochastic Modeling and Productivity Analysis of a Flexible Manufacturing System

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Abstract : Flexible Manufacturing Systems (FMS) are used to produce a variety of parts on the same equipment. Therefore, their utilization is higher than traditional machining systems. Higher utilization, on the other hand, results in more frequent equipment failures and additional need for maintenance. Therefore, it is necessary to carefully analyze operational characteristics and productivity of FMS or Flexible Manufacturing Cells (FMC), which are smaller configuration of FMS, before installation or during their operation. Appropriate models should be developed to determine production rates based on operational conditions, including equipment reliability, availability, and repair capacity. In this paper, a stochastic model is developed for an automated FMC system, which consists of two machines served by two robots and a single repairman. The model is used to determine system productivity and equipment utilization under different operational conditions, including random machine failures, random repairs, and limited repair capacity. The results are compared to previous study results for FMC system with sufficient repair capacity assigned to each machine. The results show that the model will be useful for design engineers and operational managers to analyze performance of manufacturing systems at the design or operational stages.

Keywords : flexible manufacturing, FMS, FMC, stochastic modeling, production rate, reliability, availability

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