ABSTRACT

The flexible manufacturing system (FMS) is a kind of automated manufacturing system composed of numerically controlled machines and automated material handling system to produce a variety of products. The performance evaluation method for FMS is based on discrete event systems like queueing theory or simulation. However, queueing theory is not appropriate for describing flexibility and simulation is time-consuming for design procedure.

Therefore, a symbolic performance analysis approach for FMS can be formulated based on the integration of Petri Nets (PN) models of FMS and performance evaluation of Petri Nets using moment generating function (MGF) concept. In this method, generalized stochastic Petri Nets (GSPN) are used to define performance models for FMS, then MGF based approach for evaluating stochastic PN is used to derive the performance parameters of PN, and finally the system performance is calculated.

A GSPN model of FMS is shown to illustrate the proposed method for evaluating such performance indices as production rate, utilization, work-in-process and lead time. These performance indices are symbolic functions of the design parameters of the system. The major advantage of this method over existing performance evaluation of FMS is the ability to compute symbolic solutions for performance and to automate
performance evaluation for system design and on-line system analyzer.

Keywords: Flexible manufacturing system, Performance evaluation, Generalized Stochastic Petri Nets, Moment Generating Function