

# STOCHASTIC ANALYSIS OF OPERATIONS DECOUPLING IN FLEXIBLE MANUFACTURING SYSTEMS

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*Abstract:*- In serial production systems, storage may be provided between processes to avoid interference due to lack of synchronization. In order to manufacture a product, a job is divided into individual tasks, typically manufacturing or assembly processes. These tasks are interdependent and should be coordinated. To reduce the interdependence between downstream and upstream operations and to maintain the output of the production line, it is common to introduce buffers between the operations. These buffers decouple operations and eliminate the interdependency unless the buffer is emptied when a shutdown occurs upstream. In this paper we study the buffered flows of matter in a flexible manufacturing system considering only two machines. We develop procedures to compute some steady-state performance measures, including the interference loss and some limiting distributions. We use the Markov processes theory to obtain our results.

*Key Words:*- Flexible manufacturing systems, Markov processes, Performance evaluation, Dynamical systems, Operations decoupling.

## 1. Introduction

The dynamics of continuous systems are often modeled by a set of differential equations that can express the relationships between rates of changes in the values of system state variables. Given an initial state and boundary conditions, these equations completely specify a model of the system's dynamic behavior. When this system of differential equations is particularly simple or has some special properties, it can be solved analytically to find the system's path of motion (trajectory). However, many interesting models are too complex to solve analytically and must be simulated by numerically integrating the set of differential equations (Scruben<sup>1</sup>). If the system is modeled using random processes, then the simulations can be used to generate sample paths for statistical analysis. Flexible manufacturing systems (FMS) are an important class of discrete event dynamic sys-