ABSTRACT

A Study of the Kitting Process in Low Volume Assembly Systems Operating in Stochastic Environments - A Markov Renewal Approach. (May 1994)

Pradip Som, B.E. (Hons.), Jadavpur University, India;

M.S. University of South Florida

Chair of Advisory Committee: Dr. W. E. Wilhelm

This dissertation analyzes the kitting process in stochastic assembly systems. In particular, the effects of kitting are studied in these important stochastic settings: one-time assembly; repetitive, small-lot assembly; and MRP-controlled assembly. Collectively these three types of assembly systems represent the range of operations of most relevance to industry today. For one-time assembly, processing times are modeled as mixtures of Erlangs and various measures of kitting performance are derived both for scheduling and rescheduling scenarios. The stochastic processes underlying repetitive, small-lot assembly and MRP-controlled assembly are identified as Markov renewal and semi-regenerative processes. As a fundamental result, it is shown that, if arrival streams of components follow identical Poisson processes, the output stream of kits also follow the same Poisson process if component buffers are sufficiently large. For repetitive production, G.I. distributed assembly times are considered and a numerical solution technique using the matrix-geometric approach is used to find the distribution of in-process and finished goods

inventory positions. For MRP-controlled assembly, Palm probability distributions of inventory positions at replenish order arrival times as well as distributions at arbitrary times are obtained. In both repetitive and MRP-controlled assembly, operating characteristics of kitting and measures of system performances are obtained, exploiting the Markov renewal structure of the underlying stochastic processes.