World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

An Industrial Steady State Sequence Disorder Model for Flow Controlled Multi-Input Single-Output Queues in Manufacturing Systems

Authors : Anthony John Walker, Glen Bright

Abstract : The challenge faced by manufactures, when producing custom products, is that each product needs exact components. This can cause work-in-process instability due to component matching constraints imposed on assembly cells. Clearing type flow control policies have been used extensively in mediating server access between multiple arrival processes. Although the stability and performance of clearing policies has been well formulated and studied in the literature, the growth in arrival to departure sequence disorder for each arriving job, across a serving resource, is still an area for further analysis. In this paper, a closed form industrial model has been formulated that characterizes arrival-to-departure sequence disorder through stable manufacturing systems under clearing type flow control policy. Specifically addressed are the effects of sequence disorder imposed on a downstream assembly cell in terms of work-in-process instability induced through component matching constraints. Results from a simulated manufacturing system show that steady state average sequence disorder in parallel upstream processing cells can be balanced in order to decrease downstream assembly system instability. Simulation results also show that the closed form model accurately describes the growth and limiting behavior of average sequence disorder between parts arriving and departing from a manufacturing system flow controlled via clearing policy.

Keywords : assembly system constraint, custom products, discrete sequence disorder, flow control
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020