Studying Push, Pull, and Hybrid Manufacturing Systems by Simulation

A Thesis
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By
Nahidh Jaffar Khadum
B.Sc Prod. Engineering

Supervised By
Asst. Prof. Dr. Hussein S. Ketan

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Abstract

Controlling the shop floor manufacturing situation often is an important activity for achieving high performance manufacturing control.

This research tries to study the two fundamental manufacturing control systems, being the most widely in use, namely push, pull, and the hybrid system results from them. A push system gives each workstation permission to process material based solely on the availability of the material. Whereas a pull system requires a workstation to have, in addition to material, a signal from a downstream workstation. A hybrid system is one in which there are multiple workstations, some operating with a push and some operating with a pull. While Push production control inherent the principles of Material Requirement Planning (MRP), Pull production control is often implemented using kanban systems. Pull production control is closely associated with the principles of Just-In-Time (JIT) and lean manufacturing.

Evaluating a production control system usually requires simulation modeling due to the complex interactions that occur. This research introduces a technique that control single product flow shop by Push, Pull and, hybrid production control through using the simulation modeling suggested to explore the production control. The research also demonstrates how this can be used in conjunction with existing simulation software called “Extend 6 LT to”. The software relies mainly on applying principles to deal with the waiting lines problems. Poisson’s and normal distributions are commonly used in simulation modeling for the arrival and job processing times, respectively. The decision is the location of the push-pull interface by the Bottleneck criteria as a boundary. The performance measure used to evaluate the system criteria to measure the serialized discrete event
simulation are: System output, Work In Process (WIP), Throughput, Utilization, to find the Idle Time, Waiting Time, Queue Length, and Cycle Time.

The research applied inside the State Company For Electric Industries (SCFEI) plant, the researcher is capable through the simulation, of emulating real life production systems, for the water pump manufacturing, which enables a comparison of three types of the formulated systems (push, pull and hybrid) and analysis the differences between them. The comparison reveals that push system can be characterized as high level WIP system with high throughput, while pull system can be characterized as low level WIP with the lowest resources utilization. Hybrid system Simulation results have overcomes both the systems in the aggregated output by (8.5%) and (9.8%) over the push and the pull system respectively, as it proves its superiority in Throughput rate by 6.6% for the push, and by 46% for the pull system, (2%) increasing in the system utilization for the Push, and (5%) upon the Pull. comparing to Push, the hybrid system shows a reduction in terms of Waiting Time, by (23%), WIP by (18.2%), and Cycle Time by (22%) and, an additional (2%) reduction in the Idle Time.