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# Performance Optimization on Waiting Time Using Queuing Theory in an Advanced Manufacturing Environment: Robotics to Enhance Productivity

**Authors :** Ganiyat Soliu, Glen Bright, Chiemela Onunka

**Abstract :** Performance optimization plays a key role in controlling the waiting time during manufacturing in an advanced manufacturing environment to improve productivity. Queuing mathematical modeling theory was used to examine the performance of the multi-stage production line. Robotics as a disruptive technology was implemented into a virtual manufacturing scenario during the packaging process to study the effect of waiting time on productivity. The queuing mathematical model was used to determine the optimum service rate required by robots during the packaging stage of manufacturing to yield an optimum production cost. Different rates of production were assumed in a virtual manufacturing environment, cost of packaging was estimated with optimum production cost. An equation was generated using queuing mathematical modeling theory and the theorem adopted for analysis of the scenario is the Newton Raphson theorem. Queuing theory presented here provides an adequate analysis of the number of robots required to regulate waiting time in order to increase the number of output. Arrival rate of the product was fast which shows that queuing mathematical model was effective in minimizing service cost and the waiting time during manufacturing. At a reduced waiting time, there was an improvement in the number of products obtained per hour. The overall productivity was improved based on the assumptions used in the queuing modeling theory implemented in the virtual manufacturing scenario.

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