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Simulation Modeling for Smart Manufacturing System

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Abstract: Manufacturers are always seeking ways to increase the performance of their production systems. Today, the principal ways include the use of smart technologies for data collection, analysis, prediction and decision-making. These technologies will facilitate the deployment of smart manufacturing systems to enable manufacturers achieve the increased agility needed to respond to a wide range of changes and disruptions. Smart systems can also help to reduce the environmental impacts of their manufacturing activities while simultaneously increasing equipment utilization. Modeling and simulation technologies can provide an answer to this assurance question. Appropriately designed simulation models can analyze the behavior and predict the performance of a smart manufacturing system. Both are integral to the kinds of real-time, dynamic, decision making – including decisions related to machine configuration, work schedules, maintenance, and other operating characteristics – needed for that assurance. The analysis of simulation output for specified output parameters of the performance of a production system enables evaluation and assessment of a manufacturing process's performance. In this paper, we discuss the challenges and issues associated with designing and executing those simulation models. We also discuss challenges related to data input, output analysis, and decision making. This paper outlines approaches to overcome these challenges and concludes with a presentation of a conceptual model of a new, data-driven, performance-assurance methodology.

Keywords: Smart Manufacturing, Real-Time, Decision Making, Simulation Modeling, Performance Improvement