Enhancing Manufacturing Resilience: An Integrative Framework for Human Contribution in Industry 4.0

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Abstract:

This study addresses the need to deepen our understanding of the human contribution to manufacturing resilience in the era of Industry 4.0. While current research often focuses on technological advancements, the human role remains insufficiently considered. To bridge this gap, we focus on developing an integrative framework that incorporates Human System Integration and Risk Management principles to examine the biomechanical aspects of human operator arm movements in a manufacturing environment. By addressing situation awareness and physical ergonomics that affect system performance, contributes to the understanding of the human role in manufacturing resilience within the Industry 4.0 context.

Utilizing a simulation model, this study explores scenarios by assessing the impact of factors related to operator physical strain through biomechanical analysis and comparison of postures, anthropometrics, tool mass, and moments and forces. These scenarios provide insights into how the human role can be considered in optimizing and improving adaptability and robustness in resilient manufacturing processes. We expect the outcomes to provide valuable insights into system development through the integrative framework. By employing a proactive approach to system design, it enables a holistic approach to comprehend the complexities of human-technology interactions when designing resilient manufacturing processes.