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Development of a digital twin framework for the steel bending process

Amir Cheshmehzangi

AUTHOR OF POSTER:
Amir Cheshmehzangi

INSTITUTION:
Univeristy of Warwick

OTHER AUTHORS:
Dr Michael Auinger, University of Warwick
Dr Sumit Hazra, University of Warwick

ABSTRACT:
Digital twinning technology has gained prominence by transforming physical space into a measurable digital space through analytics, modelling, simulation, and other information technologies. It enables descriptive analysis, diagnosis, prediction, and decision-making while establishing interactive mapping and closed-loop control between digital and physical spaces, maximizing its value in diverse industrial and engineering settings. This research focuses on defining a manufacturing-focused digital twinning framework, specifically addressing challenges in integrating physical and digital spaces, with a particular focus on the 3-point bending forming process. The aim is to create a closed-loop control process adjusting output, like the predicted bending angle or springback, based on input parameters such as material properties, tooling, and process parameters. A mathematical model will be developed to establish the input-output relationship, followed by analytical or numerical solutions and verification. To ensure reliable results and data accuracy over time, multiple measurement systems, techniques, performance metrics, and trade-offs are carefully considered.

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