

A Novel Robotic EDM Digital Twin for Offline Cutting-Path Programming

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Abstract. The extensive adoption of exotic materials in industries such as defence and aerospace has pushed the corresponding manufacturing system to be flexible, cut-anything and precise. A systematic literature review has shown that combining industrial robot (IR) and Electric Discharge Machining (EDM) stands out as a non-contact and near-zero force manufacturing system capable of accurately machining hard-to-cut materials. EDM principle requires electrical erosion and CNC while IR principle requires multiple axes and vibration control. Integrating such a novel manufacturing system requires adopting the transdisciplinary design of sophisticated cutting-path robot programming. Thus, to achieve industrial usability of the enhanced machining system, this paper develops a novel digital twin (DT) that can serve as a tool kinematics experimental environment while coping with complex collision and singularities of its physical twin to deliver an accurate and intuitive CNC-like coding approach for offline robotic EDM cutting path programming.

Keywords. Electric Discharge Machining, Robotic EDM Machining, Digital Twin, Robotic Offline Cutting Path Programming, Transdisciplinary Design.

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