Contribution ID: **39** Type: **not specified**

Enhancing Mechanical Design Manufacturability through Deep Explainable AI

Manufacturability is a critical factor in mechanical design, yet many engineers—especially those with limited hands-on manufacturing experience—unknowingly produce components that are difficult or impossible to fabricate. For instance, designs with sharp internal corners in milled pockets often overlook tool geometry constraints, resulting in costly redesigns and delays. This research introduces a deep explainable AI framework that automatically evaluates the manufacturability of CAD models and provides actionable feedback for improvement. The system extracts geometric features, assesses them against manufacturing constraints, and assigns a manufacturability score. When issues are identified, it recommends specific design modifications—such as softening internal corners, adjusting feature placements, or simplifying geometries—based on a dataset of high-manufacturability reference models. Trained on a large corpus of annotated CAD designs across operations like drilling and pocket milling, the model demonstrates high accuracy in identifying problematic features and delivering meaningful design enhancements. By integrating deep learning with interpretability, this work empowers engineers to optimize designs early in the development cycle, reduce costly iterations, and bridge the gap between digital design and practical manufacturing.

Special/ Invited session

Classification

Both methodology and application

Keywords

Manufacturability, Deep Learning, explainable AI

Primary authors: Prof. ALAEDDINI, Adel (Southern Methodist university); Mr DEYLAMI, Masoud (Southern Methodist University)

Presenter: Prof. ALAEDDINI, Adel (Southern Methodist university)

Track Classification: QSR-Informs