

# **A DECISION SUPPORT SYSTEM TO EVALUATE PARTS FOR ADDITIVE MANUFACTURING**

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## **Abstract**

The decision-making to implement additive manufacturing by industries is a challenging task, and they need a decision-support system supported by robust metrics. In this work, we propose a decision support system based on quantitative metrics for selecting a design that is needed to overcome the current industry's barriers to using the unique capabilities of the additive manufacturing process. The selection of suitable parts can be performed on two levels: product and part. Selecting a suitable part for consolidation is done by using the centrality score of the product network. Then for the part level, a view similarity-based shape complexity metric to guide part selection for Additive Manufacturing (AM) and advance the goals of Design for Additive Manufacturing (DfAM) is proposed. The suitable candidate for part consolidation is identified by performing complex network analysis on the product architecture or Design Structure Matrix (DSM). The product network is constructed from a part interaction matrix created from the exploded view of the assembly in any CAD modelling software. Then the centrality of each component in the product network is calculated and the component with high centrality score is selected as the candidate for PC. The view similarity-based shape complexity metric helps to improve the selection process by objectively screening many parts and identifying the parts most suited for AM. It enables experts to prioritize parts from a smaller set based on relevant subjective/contextual factors. The combined shape complexity metric (weighted sum of the external shape and internal structure complexity) has been used to rank various 3D models. The proposed shape complexity metric can distinguish parts of different shapes, sizes, and parts with minor design variations. The method is also efficient regarding the amount of data and computation required to facilitate the part selection. The proposed metric is also used to rank parts for prototyping or redesigning with additive manufacturing.