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Reducing Support Structures in Design for Additive Manufacturing: A Neural Networks Approach

Authors : Olivia Borgue, Massimo Panarotto, Ola Isaksson

Abstract : This article presents a neural networks-based strategy for reducing the need for support structures when designing for additive manufacturing (AM). Additive manufacturing is a relatively new and immature industrial technology, and the information to make confident decisions when designing for AM is limited. This lack of information impacts especially the early stages of engineering design, for instance, it is difficult to actively consider the support structures needed for manufacturing a part. This difficulty is related to the challenge of designing a product geometry accounting for customer requirements, manufacturing constraints and minimization of support structure. The approach presented in this article proposes an automatized geometry modification technique for reducing the use of the support structures while designing for AM. This strategy starts with a neural network-based strategy for shape recognition to achieve product classification, using an STL file of the product as input. Based on the classification, an automatic part geometry modification based on MATLAB© is implemented. At the end of the process, the strategy presents different geometry modification alternatives depending on the type of product to be designed. The geometry alternatives are then evaluated adopting a QFD-like decision support tool.

Keywords : additive manufacturing, engineering design, geometry modification optimization, neural networks
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