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Author: Wei-chen Lee Ching-chih Wei Shan-Chen Chung

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Development of a Hybrid Rapid Prototyping System Using Low-Cost Fused Deposition Modeling and Five-Axis Machining

Wei-chen Lee[a,*]

Ching-chih Wei[a]

Shan-Chen Chung[a]

[a] *Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taipei, 10607, Taiwan, Republic of China*

* Corresponding author. Tel.: +886 2 2737-6478; E-mail address: wclee@mail.ntust.edu.tw

Abstract

Currently, two major processes are being used to produce prototypes, namely machining and rapid prototyping. Machining is generally more accurate and precise, but it is difficult to produce objects with certain complicated features. In contrast, rapid prototyping can produce objects with complicated features, which allows materials to be used more efficiently. However, due to the uneven shrinkage and residual stresses within rapid prototyping products, their accuracy is usually uncertain. This study attempts to integrate these two manufacturing processes and develop a hybrid rapid prototyping system in order to overcome the disadvantages associated with each process and to develop new applications. Fused deposition modeling (FDM) was used as the rapid prototyping process in this work. A spindle and a low-cost FDM extruder were designed to be placed on each end of a rotary axis in the five-axis machine tool. The proposed design allows the rotation of the axis on