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ELECTRIC FIELD ASSISTED FUSED DEPOSITION MODELING PROCESS FOR ADDITIVE MANUFACTURING

THESIS DEFENSE

BY

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Abstract

Additive manufacturing has emerged as an important manufacturing technique because of its unique capability of producing complex geometries that could not easily or impossible to be produced by conventional manufacturing techniques. Fused Deposition Modeling (FDM) process is one of the seven standard categories of additive manufacturing process. However, there are a few limitations associated with conventional FDM process, such as the strict requirement on nozzle-bed distance, contaminated nozzles after, etc.

In this study, we innovated an electric field assisted FDM additive manufacturing process. By applying an electric field to a conventional FDM 3D printer, the printability under increased nozzle-bed distance was enhanced, which allows easier and quicker nozzle-bed distance tuning process. It decreases the printing failures that usually caused by the inappropriate nozzle-bed

distance and polymer to bed adherence issues in conventional FDM. In addition to that, the nozzle can be maintained clean for longer time in the electric field-assisted FDM process.

We designed and printed prototypes with both conventional FDM and electric field assisted FDM processes. The printed prototypes are then measured for change in width and height, maximum printing height (z-height), nozzle cleanliness and ability to print in reverse orientation with and without E-field. Results demonstrates that this approach can enable new capabilities and can enhance the performance of FDM printing in non-gravity environment and biomedical applications.