Massachusetts Institute of Technology

Department of Electrical Engineering and Computer Science

Proposal for Thesis Research in Partial Fulfillment

of the Requirements for the Degree of

Master of Science

Title: Spec2Fab: A Reducer-Tuner Model for Translating Specifications to 3D Prints

Submitted by:   
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Expected Date of Completion: September 2013

Laboratory where thesis will be done: Research Laboratory of Electronics

Brief Statement of the Problem:

Multi-material 3D printing allows objects to be composed of complex, heterogeneous arrangements of materials. It is often more natural to define a functional goal than to define the material composition of an object. Translating these functional requirements to fabricable 3D prints is still an open research problem. Recently, several specific instances of this problem have been explored (e.g., appearance and elastic deformation), but they exist as isolated, monolithic algorithms. I propose an abstraction mechanism that simplifies the design, development, implementation, and reuse of these algorithms. The solution relies on two new data structures: a *reducer tree* that efficiently parameterizes the space of material assignments and a *tuner network* that describes the optimization process used to compute material arrangement. As part of thesis work, I will provide an application programming interface for specifying the desired object and for defining parameters for the *reducer tree* and *tuner network*. I will illustrate the utility of my new framework by implementing several fabrication algorithms as well as demonstrating the manufactured results.

Supervision Agreement:

The program outlined in this proposal is adequate for a Master's thesis. The supplies and facilities required are available, and I am willing to supervise the research and evaluate the thesis report.

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W. Matusik, Assoc. Prof. of Elec. Eng.