

**Department of Structural Engineering
University of California, San Diego
SE 290 Seminar**



Dr. Melissa Orme
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Morf3D

"A Process Flow Guiding Additive Manufacturing of Metallic Components for Repeatable Microstructures and Mechanical Performance"

Monday, October 23, 2017

1:00 pm - 1:50 pm, Pepper Canyon Hall, Room 122

<http://structures.ucsd.edu/node/2126>

Abstract

A holistic process flow designed and implemented for Additive Manufacturing (AM) topologically optimized metallic components for use on flight hardware is described and demonstrated. The process flow aims to provide the framework for which AM parts can be fabricated with repeatable microstructure and mechanical characteristics. To this end, feedback loops guide the design and manufacturing stages of the process flow. Concerning the design stage, a Finite Element Analysis of the topology optimized design concept determines whether the design concept bears an adequate margin of safety. If not, the topology optimization exercise is revisited and the FE analysis is repeated. This cycle continues until the design concept is accepted. The second feedback loop concerns Additive Manufacturing and testing. In-process witness coupons

are Additively Manufactured with each build. The testing campaign includes coupon and artifact testing. If the results of the testing campaign are not favorable, the manufacturing step is revisited and the coupons and artifacts are Additively Manufactured with different process parameters, to be tested again. This loop continues until the results of the testing campaign insure structural components of high structural and material fidelity.

Biography

Melissa Orme, Ph.D. was born and raised in Southern California. She earned her doctorate degree in Aerospace Engineering at the University of Southern California. Melissa belongs to that small group of engineers who have participated 'hands-on' in the field of Additive Manufacturing before the term or even the industry of "Additive Manufacturing" existed. Her career has been divided between academia and small business. On the academic front, she worked as a Professor at UCI for twelve years, where she rose to the rank of Full Professor. She was an early pioneer in the field of 3D printing of metallic parts resulting in 15 US patents and 3 pending. Her cutting-edge research on net-form manufacturing of metallic components received international recognition and numerous awards, among which include the N.S.F. Young Investigator Award and the AAUW Judith Resnick Fellowship Award. During much of this time period, 3D printing machines for metallic materials were nonexistent or in a few cases, were in their research and development phase. It is fair to say that Melissa's research program was ahead of her time. Her patented inventions relevant to 3D printing are concerned with novel AM methods with molten metal micro-droplets, novel methods of customizing the size distribution of metallic powders, and high speed direct circuit board printing.

She currently serves as CTO of Morf3D, Inc., a start-up company that is focused on Additive Manufacturing of metallic components primarily for the Aerospace and Defense Industry. In that capacity she oversees the company's AM development programs for small lot production, which includes new material parameter development, novel AM design implementation, component validation and qualification. Melissa continuously evaluates new Additive Manufacturing technologies for inclusion into Morf3D's offerings. She is pleased to be afforded the opportunity to have been involved in Additive Manufacturing from the early research days in the late 1980's to its current implementation in industry.

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*Sponsored by Professor Alicia Kim
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