Additive Manufacturing: In situ measurement to improve process knowledge and validate models

Additive Manufacturing (AM) enables parts to be built through the layer-by-layer addition of molten metal. In Directed Energy Deposition AM, metal powder or wire is added into a melt pool that follows a pattern to fill in the cross section of the part. When compared to traditional manufacturing processes, AM has many advantages such as the ability to make internal features and to repair high-value parts. However, the large thermal gradients generated by AM result in plastic deformation. Developing accurate thermo-mechanical models enable the temperatures and distortion to be understood and controlled. Typically these models are validated by measuring the temperatures during the deposition of a small part and the final distortion of the part. Unfortunately this is not a sufficient validation method for non-linear thermo-mechanical models of AM processes which can require a significant amount of processing time. Instead, in-situ techniques must be developed to provide a sufficient validation of the model. This presentation will discuss the unique considerations of AM processes, as well as the efforts to acquire measurements for model development and validation.

About the speaker: Jarred Heigel is a Ph.D. Candidate at Penn State University in the Mechanical and Nuclear Engineering Department. His research interest is in manufacturing processes, specifically developing and performing in situ measurements to gain insight into the processes and to validate models. He is currently investigating metal additive manufacturing. Before enrolling at Penn State, he researched metal cutting with the National Institute of Standards and Technology (NIST) using high-speed dual-spectrum microvideography. His research career began as an undergraduate research assistant, investigating the possibility of using electric current to reduce the flow stress in metal during forging operations. In 2011 Jarred was awarded a National Science Foundation (NSF) Graduate Research Fellowship.

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All are invited!