1135-35-2079 **Alex Plotkowski***, plotkowskiaj@ornl.gov, and **M. M. Kirka**, **R. R. Dehoff**, **Y. Lee**, **N. Raghavan**, **M. Haines**, **A. Prabhu**, **H. Rezayat** and **S. S. Babu**. *Applications of PDEs to Process Modeling of Metal Additive Manufacturing at mm- and sub-micron Length Scales.*

Mechanical properties and component level performance are intimately linked to microstructure, which is in turn dictated by the spatial (nm to mm) and temporal (10-6 to 10-1 seconds) response of the material to the manufacturing conditions under which it was produced. Understanding these linkages is necessary for ensuring quality while minimizing cost and maximizing reliability. Process modeling relies on solving highly coupled partial differential equations under complex boundary conditions. While extensive progress has been made in the last three decades to improve the fundamental understanding of the relevant physical phenomena, recent interest in metal additive manufacturing has posed new challenges in spanning disparate length scales and considering complex interactions between geometry, process, and material. This presentation will introduce approaches that have been successfully used for modeling of conventional metals processing and their recent applications to additive manufacturing. Special attention will be paid to emerging challenges and opportunities in additive manufacturing, including state of the art computational modeling, reduced-order approaches, and the use of advanced modeling capabilities to described integrated component-structure-process optimization. (Received September 25, 2017)