Laser Metals Additive Manufacturing Process Simulation Software Landscape

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Abstract

Laser based metals AM processes are increasingly being used as a production process for complex aerospace, power generation, and biomedical end use parts. While metals AM equipment is generally considered robust, the science and understanding of the process physics is lagging. Support structures are required to fixture the metals AM part to the platen to overcome the thermal stresses that accumulate during the build process. Insufficiently supported parts can result in support failure at the interfaces of the platen,supports, and parts. This can cause build failures due to impact of the recoater and the part under construction or the build may complete but the support failures allow for significant deformation rendering the part unusable. The lack of software to guide operators of metals AM equipment has resulted in low first time build success due to trial and error orientation and support strategy iterations and a rule of thumb and/or tribal knowledge of the process. This is becoming increasingly important as designers are utilizing topology optimization and light-weighting tools that result in extremely complex shapes. In the past year most major CAD/CAM software companies have made significant investment in AM process simulation tools either by acquisition or internal development.

These new software tools can assist in evaluating the effect of part orientation on deformation/warpage, create stress based support solutions to increase first part build success, generate compensated geometry and understand how secondary thermal processing may affect part properties. This presentation will cover the available AM software tools and how to incorporate AM simulation into metals AM production work flow.

Bio

Tim Gornet is the Manager of Operations at the University of Louisville's Rapid Prototyping Center. He has been active in the additive manufacturing (AM)/3D printing field since 1988 when he ran an SLA 250 at GE Appliances. He is Past President of the Additive Manufacturing User's Group (AMUG), founded the Selective Laser Sintering User's Group and served as president 3 years, has been a board member for the Society of Manufacturing Engineers Rapid Technologies and Additive Manufacturing group and was recognized as one of the "Top 25 Most Influential People in RPD&M" by the TCT Magazine. He is a frequent contributor to the annual Wohlers Report and presents at numerous industry and academic conferences on AM. His research is in the area of polymer sintering and previous work includes pioneering the use of the Melt Index for determining powder quality and developing a multi-zone heating system that has now been commercialized. Recent funded research includes several ONR/AFRL SBIR/STTR projects on unique polymer laser sintering materials and high temperature polymer applications as well as development of new materials and processing parameters for Direct Metal Laser Sintering. In addition, he has led polymer laser sintering research programs with Boeing for novel aerospace application. His research area of interest are in Laser Sintering of Polymers including process control and optimization, mechanical properties, hardware improvements, materials research and development, and high temperature materials. In the area of powder bed metal additive manufacturing technologies his research includes material development, process and mechanical property optimization. He also performs applied research in design for Additive Manufacturing for polymers and metals. He received his Bachelor and Master of Engineering degrees from the University Of Louisville JB Speed School of Engineering and is completing his PhD work at the University of Sheffield (UK)