

## Process simulation of Additive Manufacturing

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### PROJECT DESCRIPTION / DIRECTION(S) / INFORMATION

Additive Manufacturing (AM), also known as ‘3D-printing’, builds components from metal alloy powders or wires by selective laser or electron beam melting. It produces near-final-shape components directly from computer design files without the need for tooling, leading to material savings of up to 90%, production cost savings of up to 50% and reductions in leadtime from design to final component of up to 90%. During an additive manufacturing process for metallic materials, such as selective laser melting, the most popular 3D-printing technique for metallic materials, complicated physical phenomena, including powder melting, liquid solidification, solid remelting and solid to solid transformations, occur. Such a manufacturing process will lead to residual stresses in the as-produced components. To successfully predict the residual stresses will enhance the application of AMed components in load-bearing structures, especially in aerospace engineering.

This final year project will use an open source software to simulate an additive manufacturing process to predict the residual stress field in an AMed component. This software was developed by Los Alamos National Laboratory, USA:

<https://github.com/truchas/truchas-release/>.

As the supervisor has never used this software before, the students working on the project must have the initiative in carrying out the research. In addition, the students should have a good knowledge of thermodynamics and be interested in computational simulations and programming.