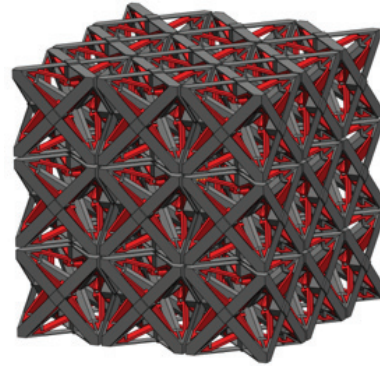


Design Optimization for Additive Manufacturing

Recent advances in material design and fabrication have enabled production of customizable materials for a wealth of applications. Towards this end, Livermore researchers, in collaboration with external partners, are developing prototype additive manufacturing techniques to build highly optimized materials. The techniques allow designers to alter the 3D micro-architecture of a material to control its structural, functional, thermal, or other properties. As a result, materials can be made stronger, lighter, tougher, and more resistant to natural forces and external conditions, such as temperature fluctuations.

Design optimization for additive manufacturing is used to create designs that fully exploit the capabilities of these newer manufacturing processes, and explore that design space more efficiently. These methods help speed experimental redesign, allowing researchers to manipulate input parameters and simulate outcomes tailored for a specific fabrication technique. As a result, researchers can determine the best design options for achieving a material with a desired resolution and geometry.

Computational power, scalable engineering design, and optimization codes help create designs that fully exploit the new fabrication capabilities. Additive manufacturing machines can upload a computer model of a component with an arbitrary shape and size and build the part to precise specifications with no additional assembly required.



This computer model shows a structure made from designer materials that has been optimized to limit thermal expansion.



Advanced body armor requires lightweight, breathable material that can withstand extreme force and fire. Optimized designer materials are ideal for body armor applications and are called for in the White House Advanced Manufacturing Strategic Plan.

LLNL research areas include development of the following:

- ⦿ Extremely lightweight, very stiff materials
- ⦿ Materials that maintain their shape when heated or cooled
- ⦿ Durable materials with low radar signature
- ⦿ Armor materials with 1/10th the weight

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.