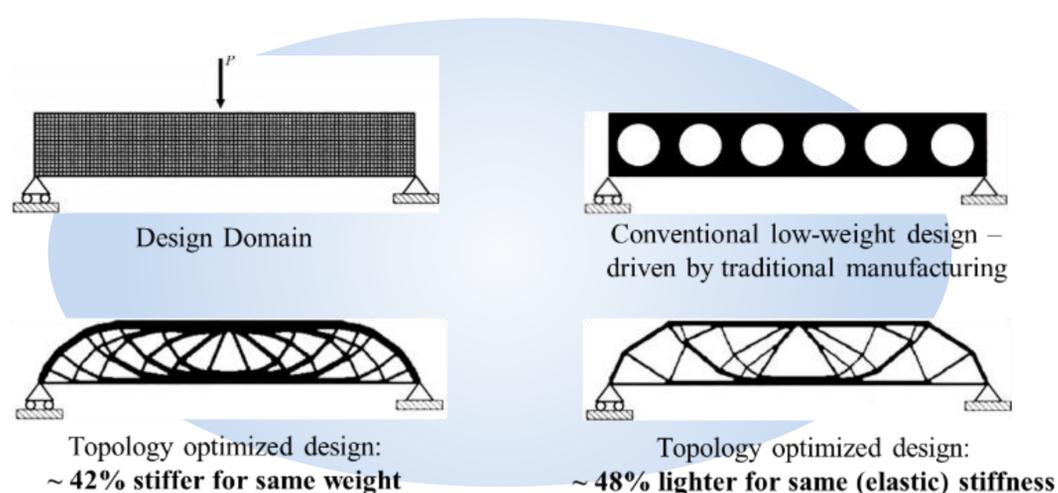


S&T Campaign: Materials Research
Manufacturing Science
Advanced & Additive Manufacturing

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Research Objective

- Develop advanced topology optimization (TO) methodologies for design of multi-functional multi-material (MFMM) components
- Enhance TO with concurrent multiscale modeling, multiobjective topology optimization, and realistic manufacturing constraints and models



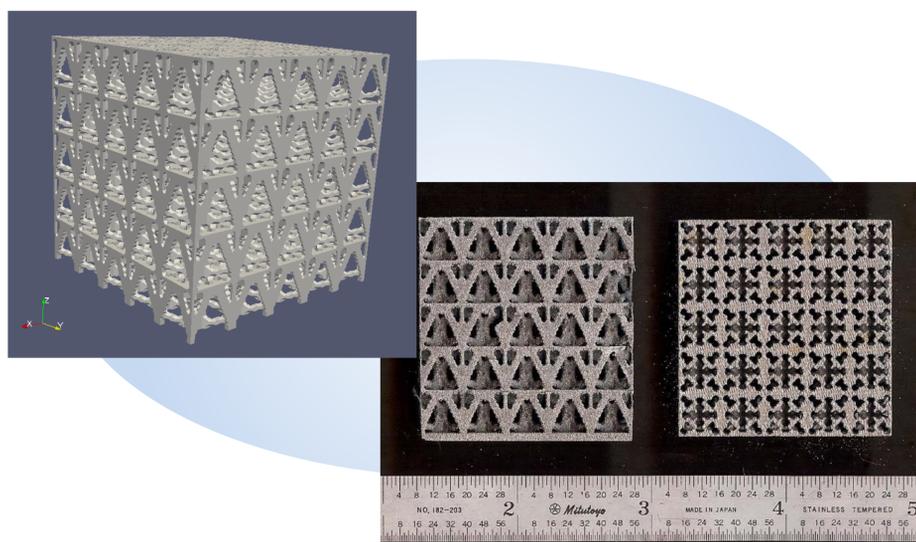
Topology optimization vs. traditional design

ARL Facilities and Capabilities Available to Support Collaborative Research

- General topology optimization software framework
 - Extensible topology representations
 - Extensible optimizers
 - Extensible objective functions
 - Community source project on forge.mil
- Extensive additive manufacturing capabilities
- Projects focused on
 - Additive manufacturing
 - Multifunctional/multimaterial designs
 - Fatigue-resistant designs (VTD)
- Facilities
 - MTS Servo-hydraulic mechanical testing machines
 - Laser cutters
 - Dimension Elite 3D printer
 - Objet Eden 260VS
 - Stratasys Fortus 400 FDM (3D Printer)
 - Wind tunnel

Challenges

- Accurate, but efficient forward models for a large set of problems: Structural, EM, thermal, etc.
- Better topology optimization algorithms for multiscale, multimaterial designs
- Computational requirements are burdensome for large-scale problems



Truss designed for compression

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- Large compute clusters
- Antenna testing facilities
- Additional additive manufacturing capabilities, especially multimaterial manufacturing
- Novel methods to improve computational efficiency of optimization
 - Derivative-free optimization
 - Novel reduced data topology representations
 - Efficient forward solvers
 - Highly parallel solvers and optimization algorithms
- Novel applications for topology optimization