



Naval Research Laboratory - Office of Naval Research Materials Science and Technology

<http://mstd.nrl.navy.mil>

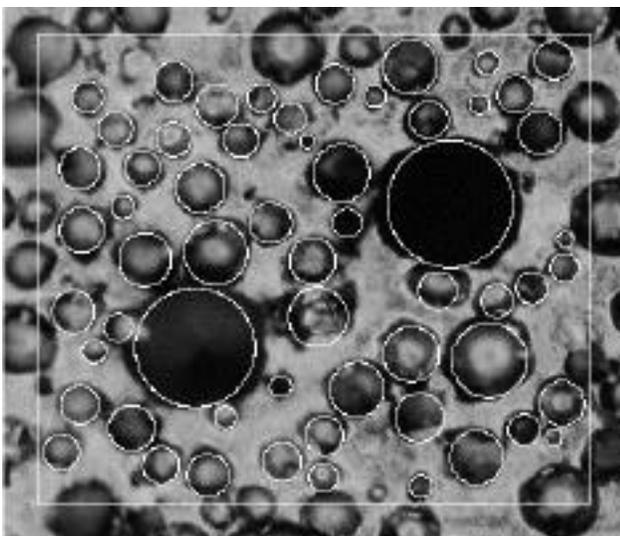
Science and Technology Success Stories

Image-Based Modeling of Material Response

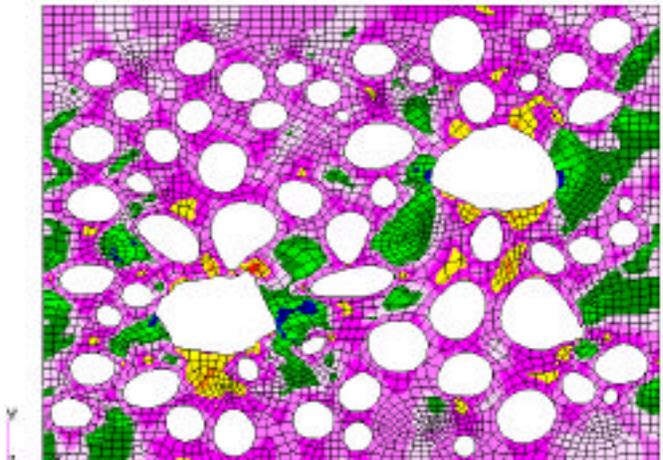
The Naval Research Laboratory (NRL), the Navy's corporate laboratory, has an extensive program in modeling and simulation of materials properties and structural response to complex stimuli. A hallmark of this work is the faithful translation of geometric or microstructural details into finite element meshes.

The process begins with a metallographic, scanning or transmission electro-optical, or x-ray image of the material microstructure or structure to be studied. Digital image analysis is used to extract salient features used for input into mesh generation. Currently, tens to hundreds of objects may be handled in this manner in two or three dimensions. An integrated approach of performing critical experiments coupled with realistic computational modeling extracts the maximum amount of information.

Image-based simulations have been performed on HY100 steels, GASAR porous metals, and porous polymers. Additional applications for this methodology are actively sought.



Porous Polymer with Undeformed Model Region Shown



Finite Element Model of Compressed Porous Polymer
Showing Local Areas of High Strains (In Green)

Image-Based Modeling of Material Response

Military Impact

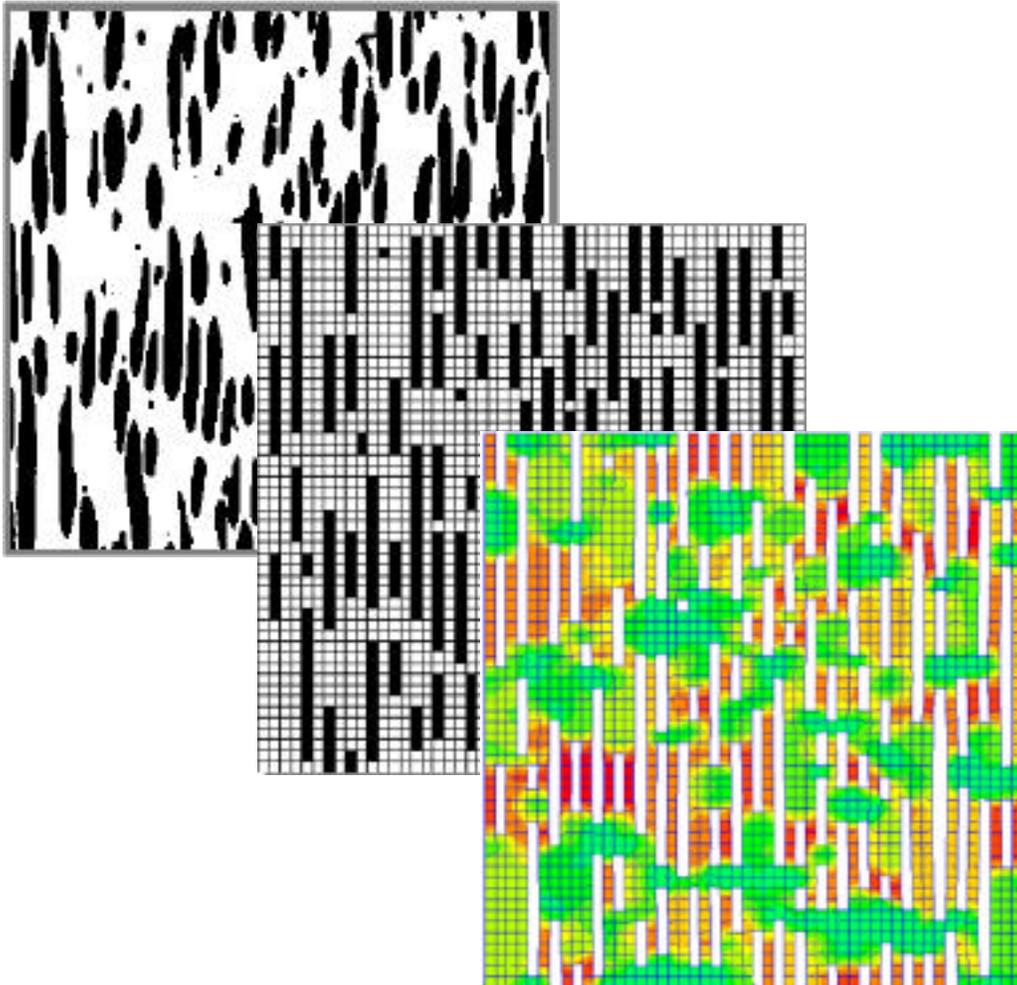
- Image-Quality Simulation Tools
- Improved Predictive Capability for:
 - Structure Response Simulation
 - Damage Tolerance (Survivability)
 - Lethality

Potential Civilian Spin-offs

- Simulation Capabilities for:
 - Aerospace Structures
 - Automotive Structures
 - Bio-Medical Implants

Point of Contact

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Evolution from binary image to finite element analysis for a porous metal