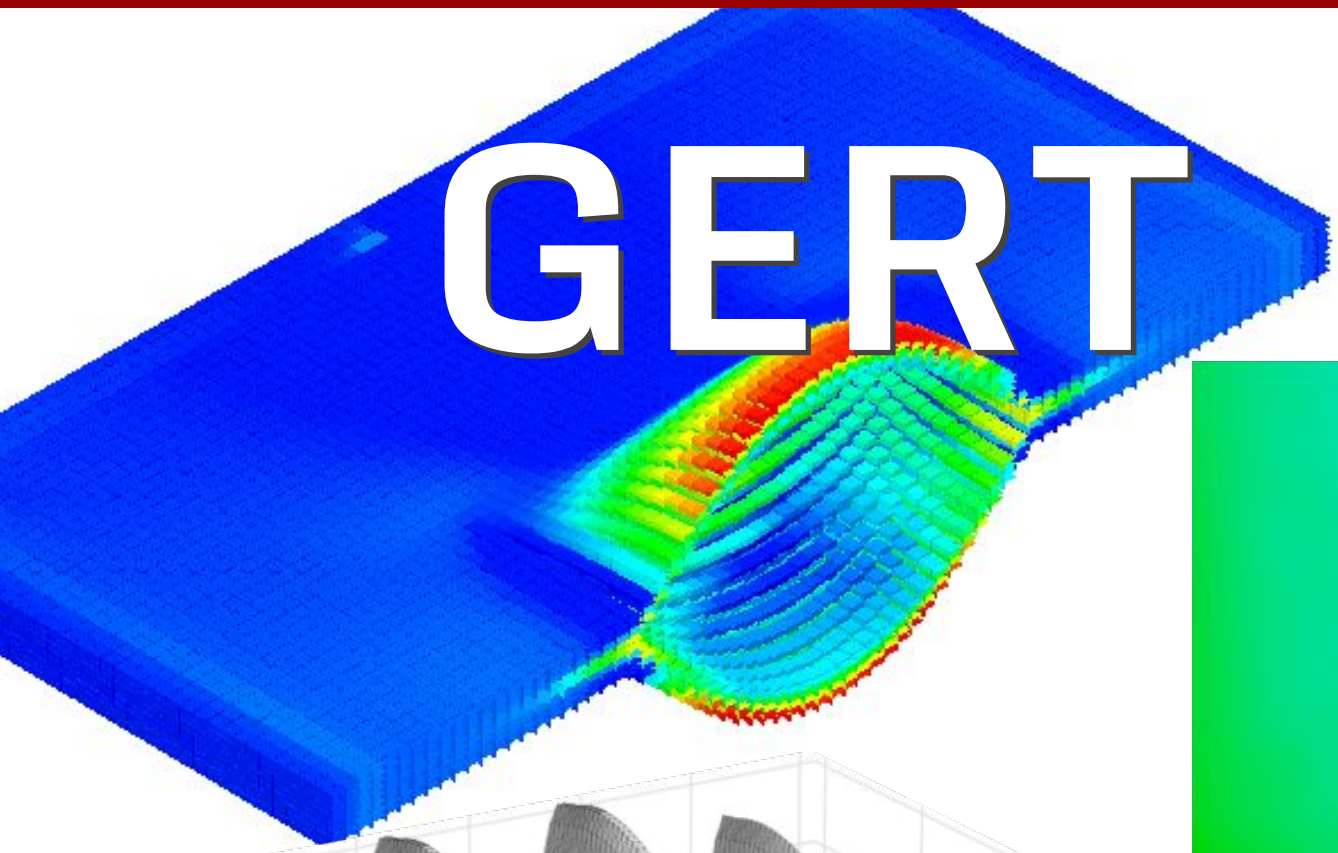
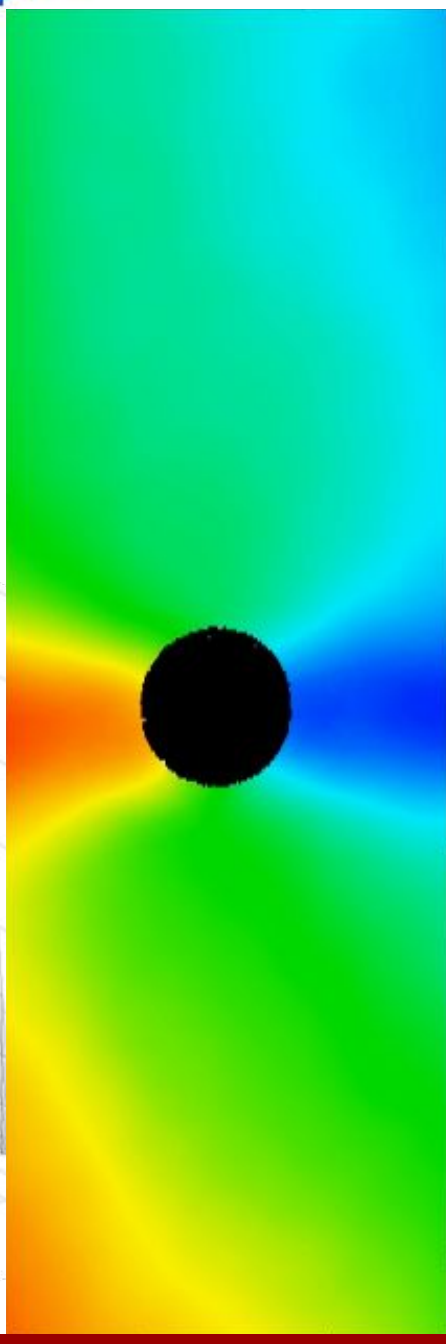
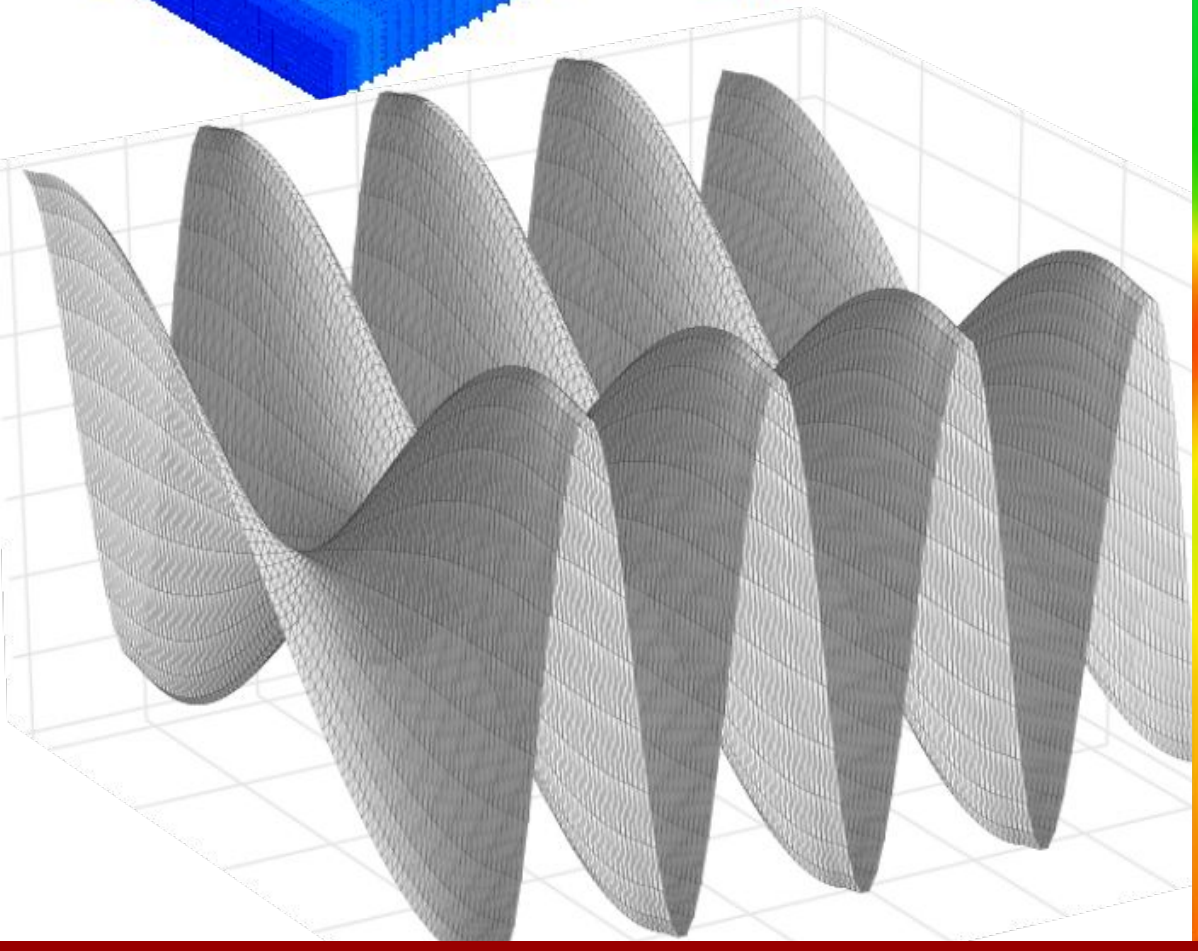
GERT







GLOBAL ENGINEERING RESEARCH AND TECHNOLOGIES

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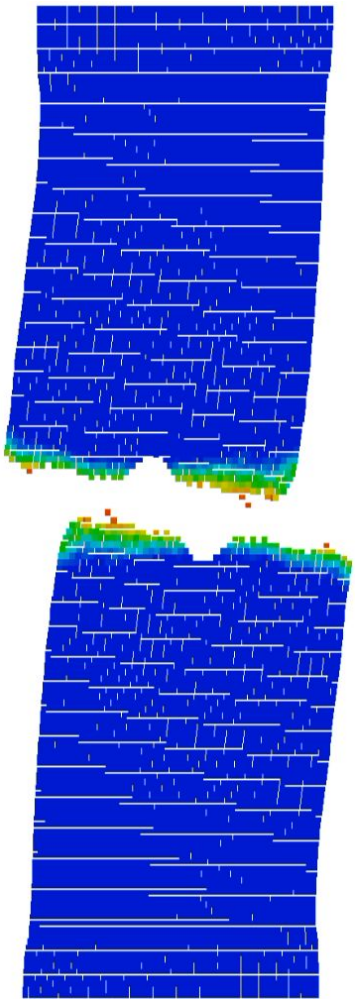
Global Engineering Research and Technologies

The Company

GERT is an upstart company which focuses on the development of state-of-the-art software tools to solve problems in diverse engineering fields, ranging from the prediction of failure modes in structural and electronic materials to medical imaging and image reconstruction. The software algorithms are based on a relatively new powerful theory called Peridynamics (PD).

Case in point, GERT is developing for the Navy a PD software package for the prediction of distinct failure modes observed in thick composite components. The technology that is currently used by Navy is based on Finite Element Analysis (FEA) with cohesive zone elements and extended finite elements. FEA is robust in particular for determining stress fields, and it is also exceptionally suitable for modeling structures possessing complex geometries and different materials under general loading conditions. However, FEA is not very suitable when it comes to damage and fracture modeling. The main difficulty lies in the fact that the mathematical formulation on which FEA is based breaks down whenever a discontinuity appears in the material. In contrast, material damage is part of the PD constitutive laws. PD attributes permit damage initiation and propagation to be modeled, with arbitrary paths, without the need for external criteria.



GERT's software targets a wide range of commercial and defense organizations:

- DOD
  - All branches.
- Other government agencies that perform large scale simulations. Examples include:
  - NASA.
  - Government labs (e.g., Sandia, Los Alamos, Oak Ridge, Argonne, etc.).
- Private companies that perform computational simulations:
  - Aero/defense: Boeing, Lockheed Martin, Raytheon, etc.
  - Automotive: Ford, GM, Chrysler.
- Academic institutions.

Services

GERT specializes in the following fields and offers services related to the following topics:

- Fatigue/Failure Modeling & Analysis
- Finite Element Modeling & Analysis
- Peridynamic Theory Modeling & Analysis

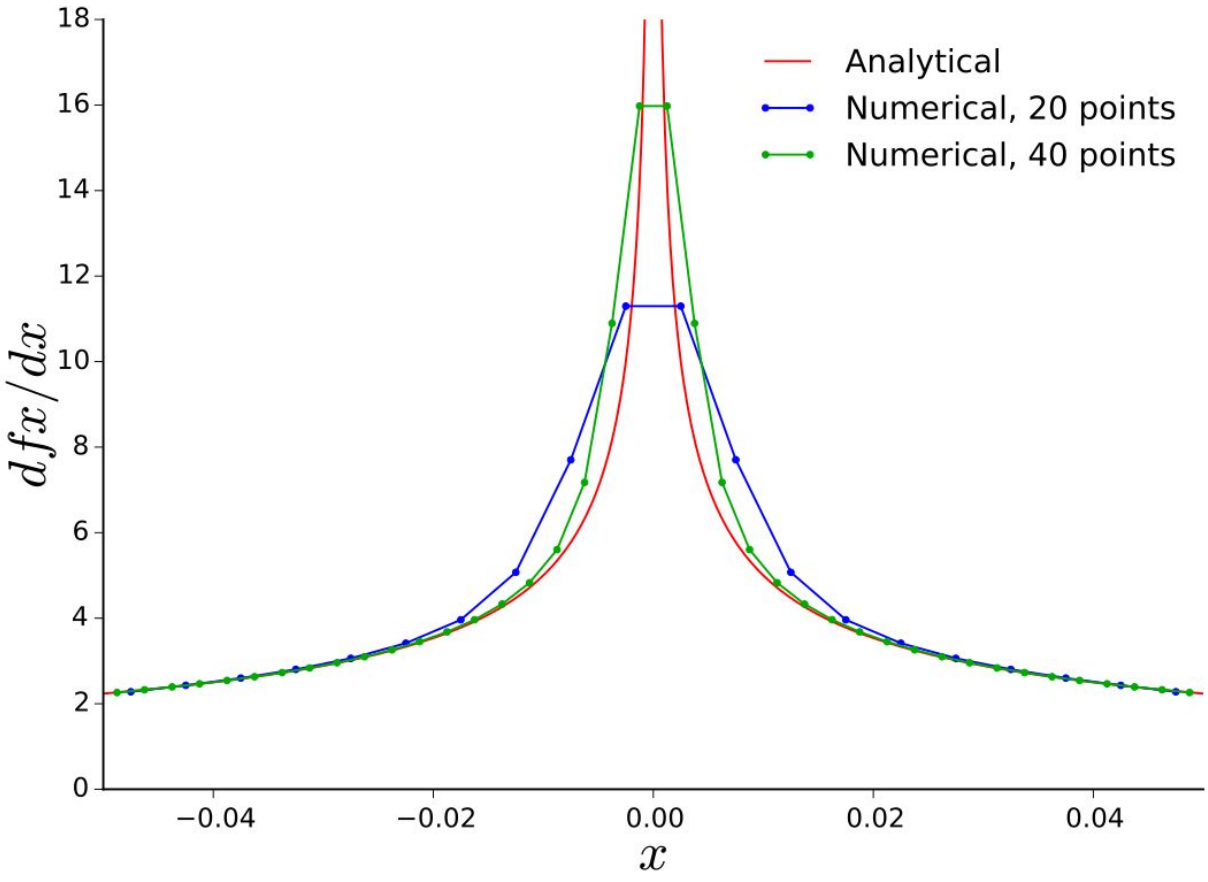
Products

Scarf Joint Processor

The Scarf Joint Processor is a comprehensive user interface that handles the preprocessing, solution, and postprocessing for a simulation of composite repair using scarf joints. The interactive interface allows for hundreds of parameters to be set in order to achieve the most accurate results when modeling and viewing solutions in 2D and 3D.

Differential Solver

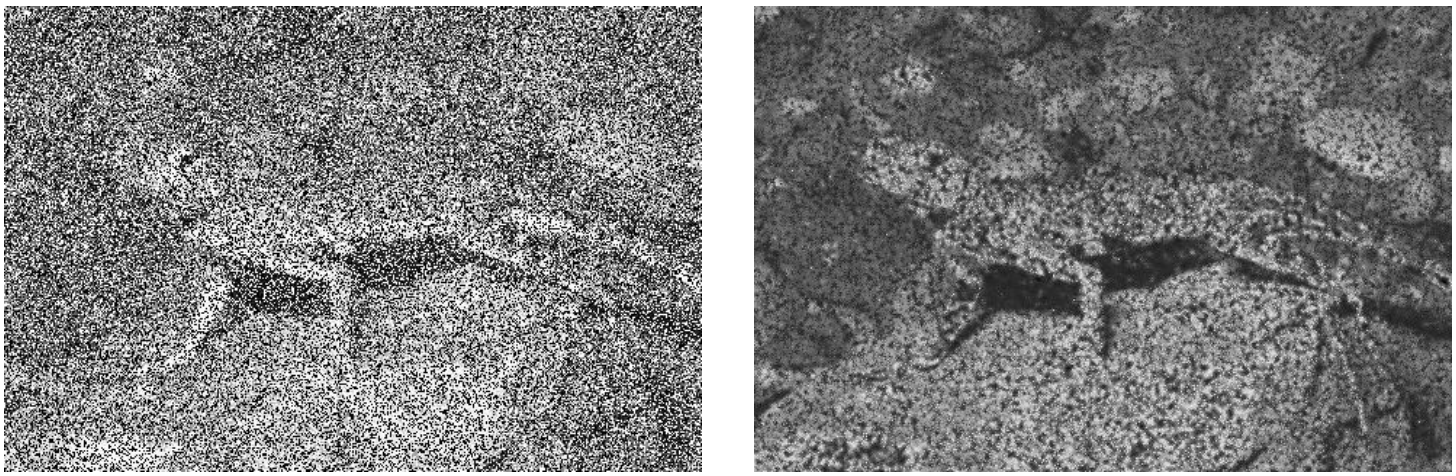
This particular application of peridynamic theory allows for numerical differentiation and solution of differential equations more accurately than traditional methods. This tool has an interactive user interface that allows for viewing original data and solutions to various differential calculus problems.



Numerical solution to a differential equation with a discontinuity, shown at various resolutions.

Image Analysis and Data Recovery

Peridynamic theory can be applied to fill in missing data in various data sets. As a proof-of-concept, the image analysis tool can be used to fill in any masked part of an image, allowing for various applications, such as compression, recovery, healing brush, despeckle, scaling, and more.



Despeckling example, with original image (left), and recovered (right).

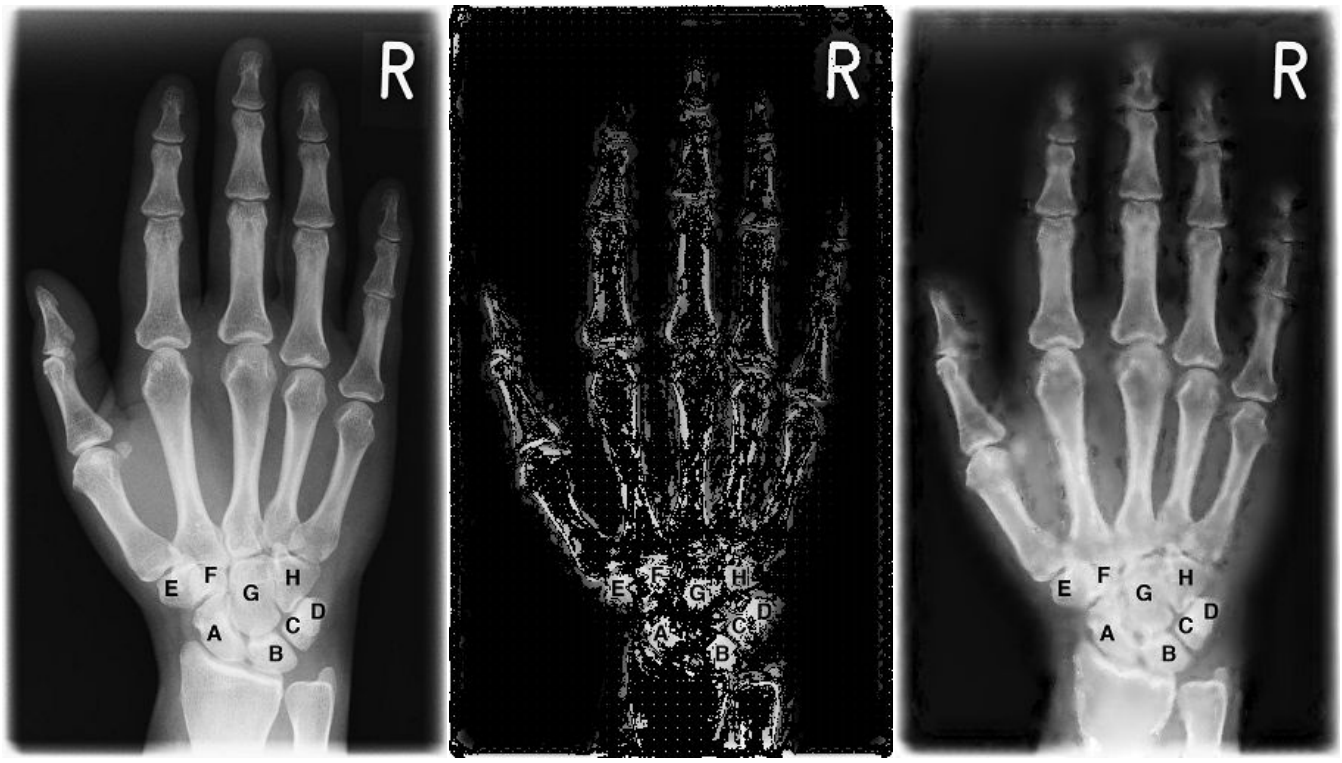
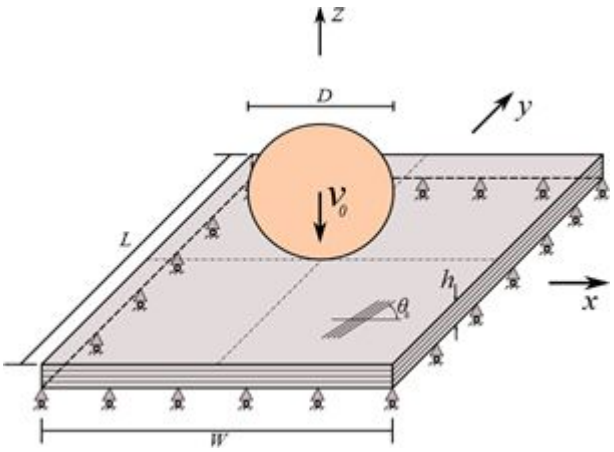


Image compression and recovery using Peridynamics. Original image (left), compressed with ~85% of the data removed (middle), recovered image (right).

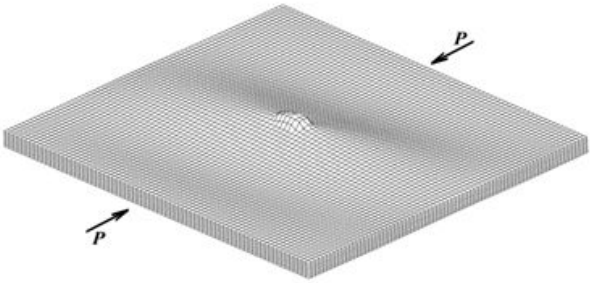
Peridynamic Processor

The peridynamic processor simulates impact, force, and fracture simulations of layered laminates. With options to view fully 3D model contour plots of damage, displacement, and more; this processor is highly versatile. The interface uses custom 3D rendering software to allow for smooth viewing of simulations containing millions of points.

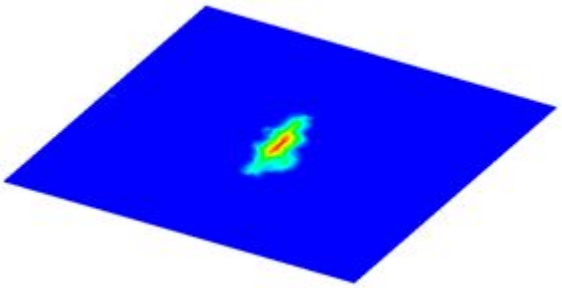


Impactor problem configuration.

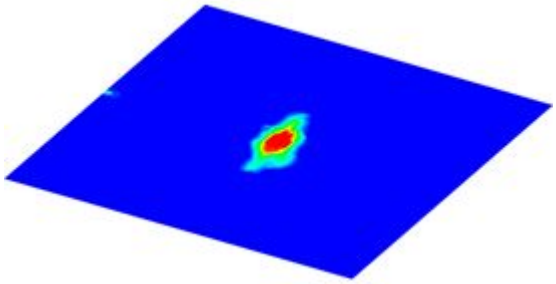
Deformation after impact (bottom view)



Compression after impact



Matrix damage after impact



Further matrix damage due to compression

Related Grants, Awards, and Publications

Peridynamic Differential Operator and Its Applications
Journal of Computer Methods in Applied Mechanics and Engineering
Accepted for Publication - October 2015

Failure Avoidance in Microelectronics Due to Coefficient of Thermal Expansion (CTE) Mismatch of Substrates and Adhesives *Phase I STTR Grant - Missile Defense Agency, 2015*

Thick Composite Crack Analysis, *Phase II SBIR Grant - Navy, 2014*

Residual Property Prediction for Damage Composite Structures *Phase II SBIR - Army, 2014*

Thick Composite Crack Analysis *Phase I SBIR, 2013*

Total Fatigue Life Assessment of Complicated Structures *Phase I STTR - Navy, 2012*

Residual Property Prediction for Damage Composite Structures *Phase I SBIR - Army, 2012*

High-Fidelity Residual Strength and Life Prediction Tool for Adhesively Bonded Composite Structures *Phase I SBIR, 2012*

Algorithm Development for Multi-Core GPU-Based Computing Architectures *Phase I STTR - Air Force, 2010*

Durability Modeling and Simulation of Composite Materials *Phase I SBIR - Army, 2010*

Innovative Analysis Tool for Damage Growth From Loaded Composite Fastener Holes *Phase I SBIR - Navy, 2009*

Combined Analytical and Experimental Approaches to Rotor and Dynamic Component Stress Predictions *Phase I SBIR - Navy, 2008*

Contact Information

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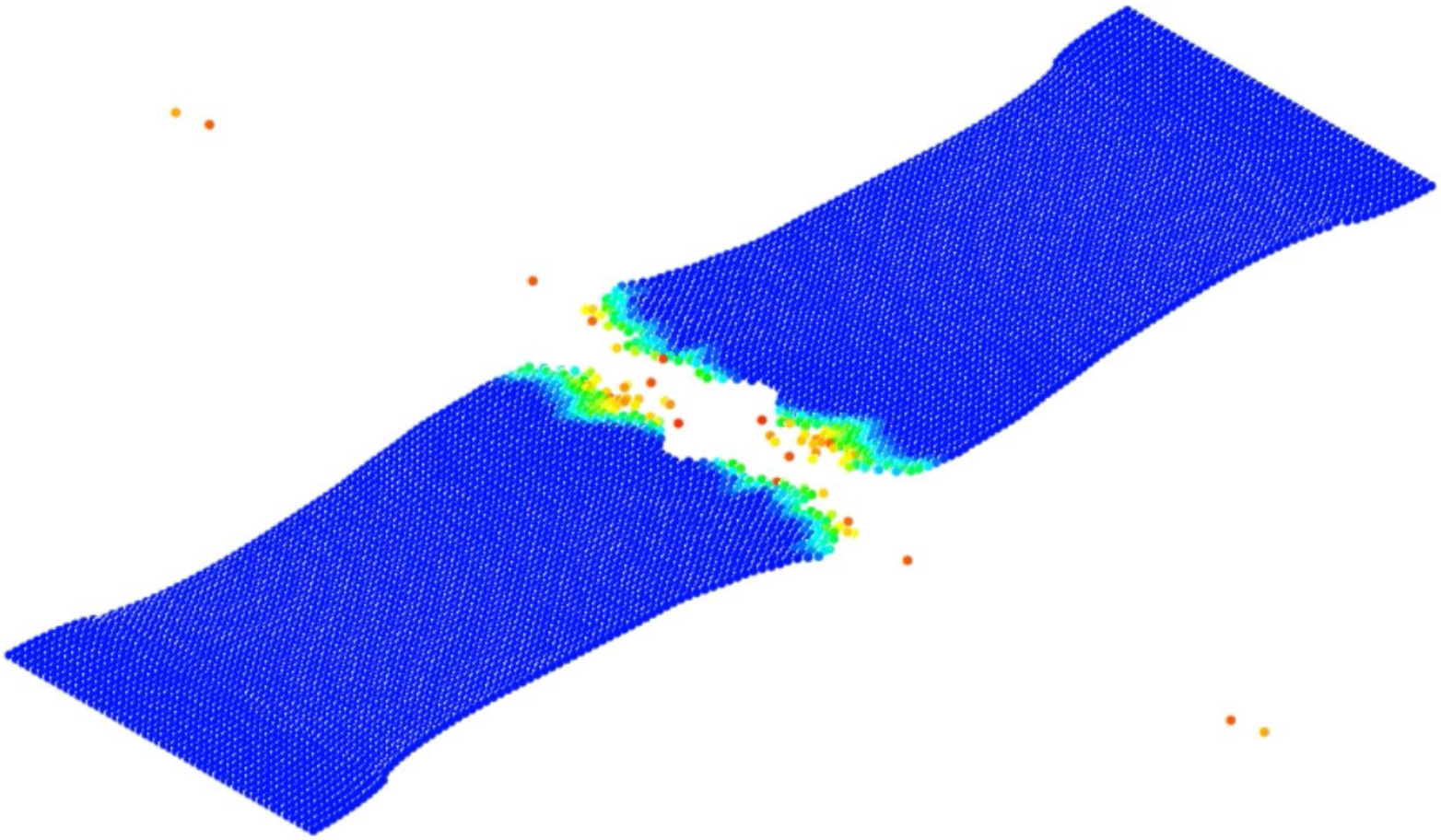

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