Dynamic Energy Dissipation for Earthquake Protection, PSED Cluster 2009-2010

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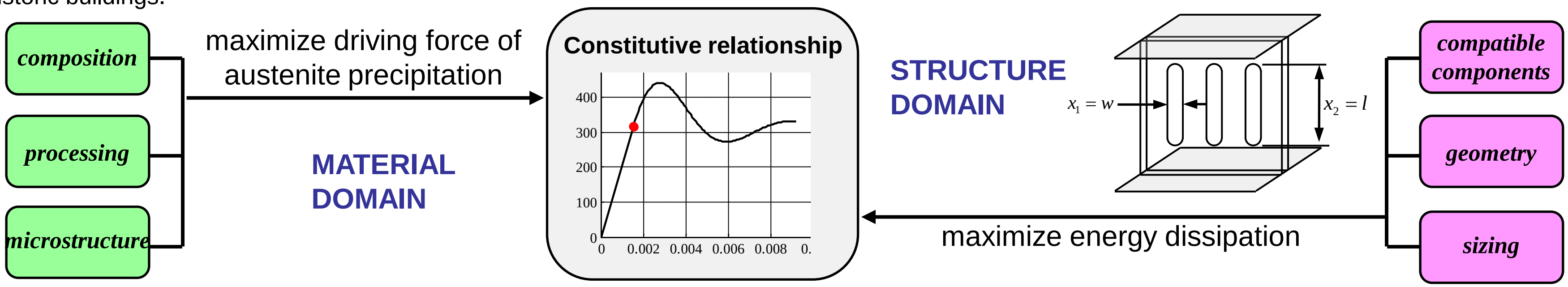
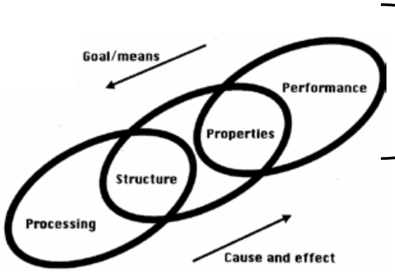
RESEARCH OBJECTIVE

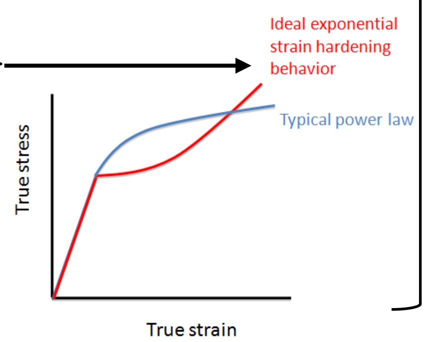
Integrate contemporary materials and structure analysis & design principles to create products with better functionality as ***passive energy dissipation*** devices. Through exploring the codependent physics in the material (nano, micro) and continuum (meso, macro) domains, automated design techniques utilize experimental data, structural concepts, and atomistic and continuum simulations to consider mutual design issues across disparate scales in length and time. The end mission of the project is to use the integrated design approach to unlock new devices for earthquake protection, with a specific focus on historic buildings.



BENCHMARK PROBLEM

- Preliminary material and structural design of slit steel damper
- Optimal combination of material & geometry sought
- Dissipation occurs through metal yielding
- Material/structure integration through constitutive relationship

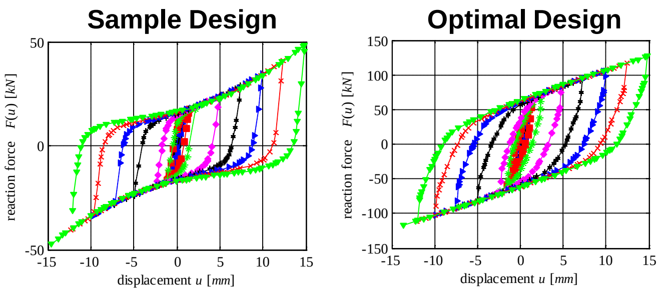




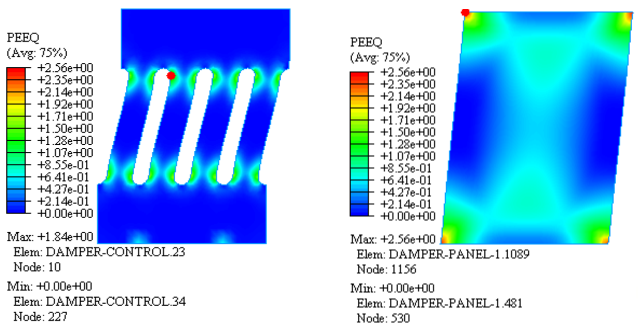
Class of secondary hardened Martensitic steel is considered to exploit transformation plasticity.

Materials design provides optimal constitutive relationship for energy dissipation

Structural design produces solid shear panel, confirmed by literature, due to highest plastic strain from mobilized shear deformation



Cyclic loading hystersis loop



Equivalent plastic strain field

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Optimal Design of Marine Composite Sandwich Panels for Underwater Blast Resistance, PSED Cluster 2009-2010

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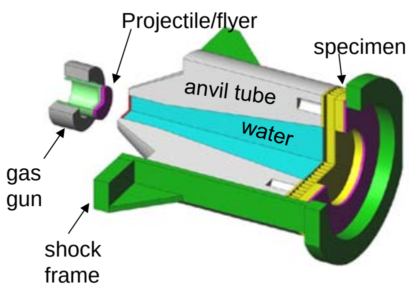
RESEARCH OBJECTIVE

A combined experimental-numerical approach to understand the failure mechanisms of marine sandwich composites, develop a predictive modeling capability for their response and optimally design the composite panels.

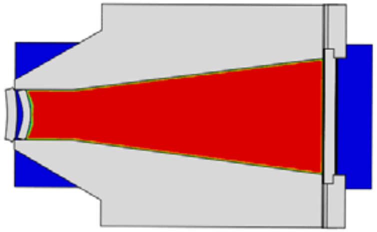
APPROACH

- Perform Fluid-Structure Interaction (FSI) experiments at lab scale
- Build numerical model for the FSI experiment
- Build *meta-model* combining simulation and experimental data to speed up prediction
- Numerical optimization, which requires several hundreds of predictions, also speeds up

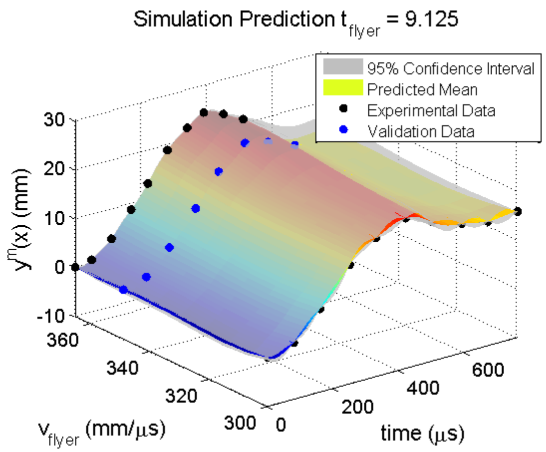
Test Setup



Specimen diameter, Φ =290 mm



FE model



Metamodel

t_1

t_2

t_3

Optimal Design

Integrated DEsign Automation Laboratory

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