



New Mexico Research Spotlight Forum

3/5/2019

Engineering Mechanics & Dynamics

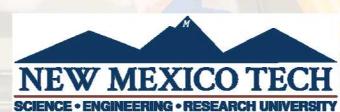
Dynamic Impact Hazards and Material Failure

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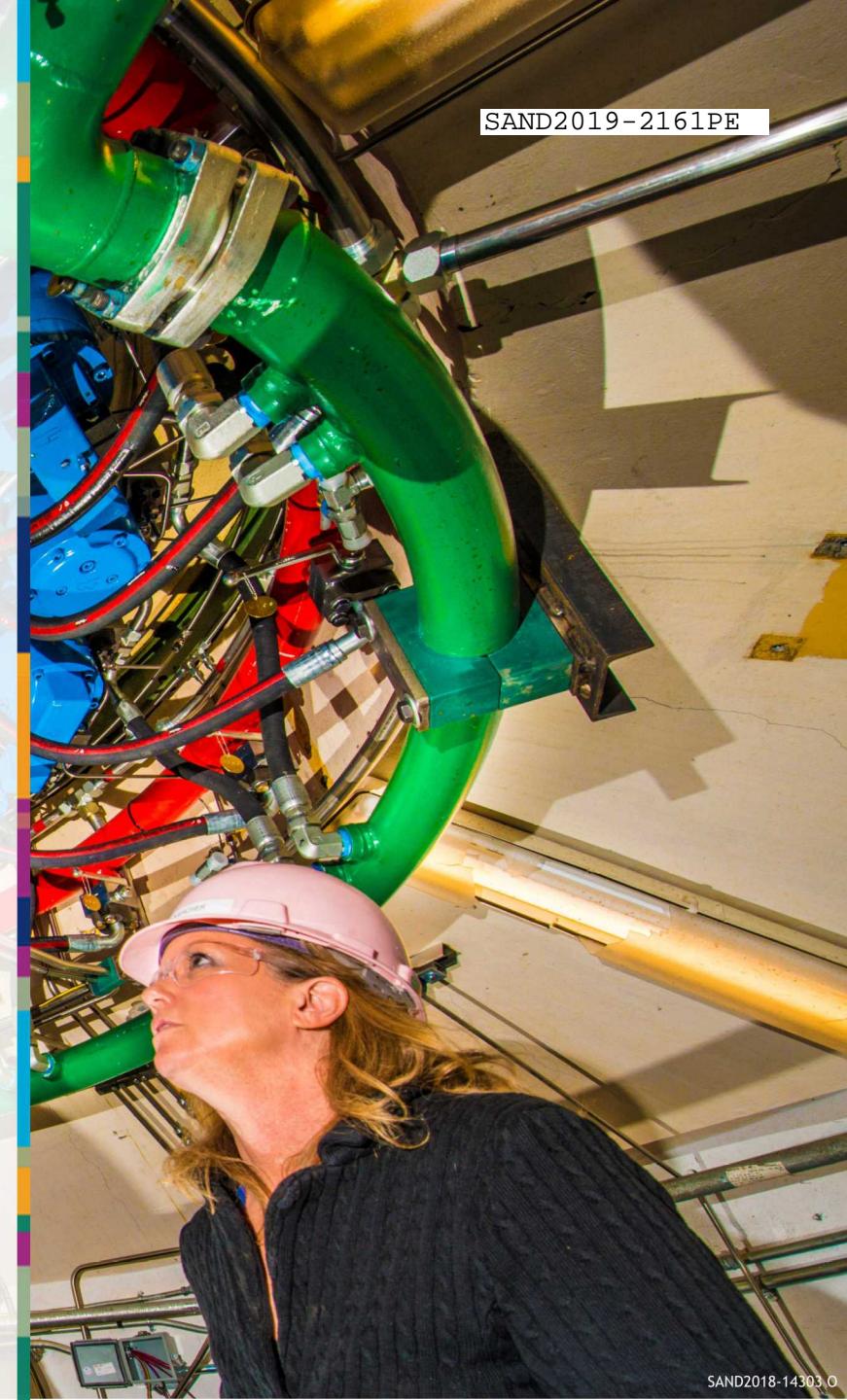
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Capability Overview



SAND2019-2161PE



SAND2018-14303.O

Department 9432 focuses on developing safe processes for maintaining complex systems.

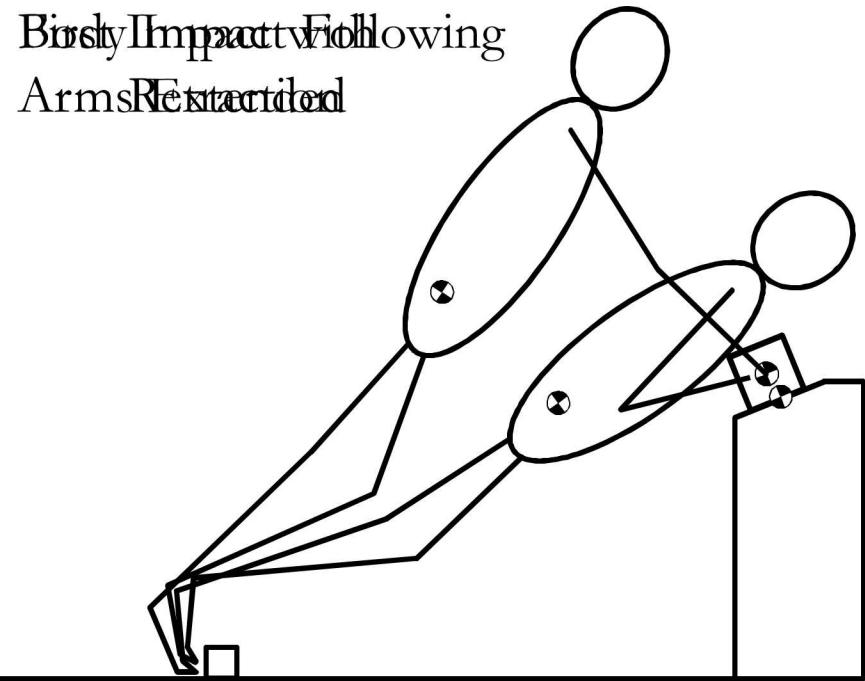
- Nine members with degrees from U of U, UT Austin, USU, USC, UNM, U of I, UE, Purdue University, NMT, NMSU, MIT, CSUN, Colgate University, and BYU
- Experience in safety engineering, electromagnetism, electronic component failure, robotics, hydrodynamics, thermosiphons, clean energy, material characterization, mathematics, astronomy, physics, education, additive systems analysis, explosive effect analysis, MEMS, aircraft structural analysis, satellite component design, machine design and analysis, and manufacturing
- Research interests include design for safety, ductile fracture mechanics, failure of composites, failure of weldments, multi-physics simulations

Keywords:

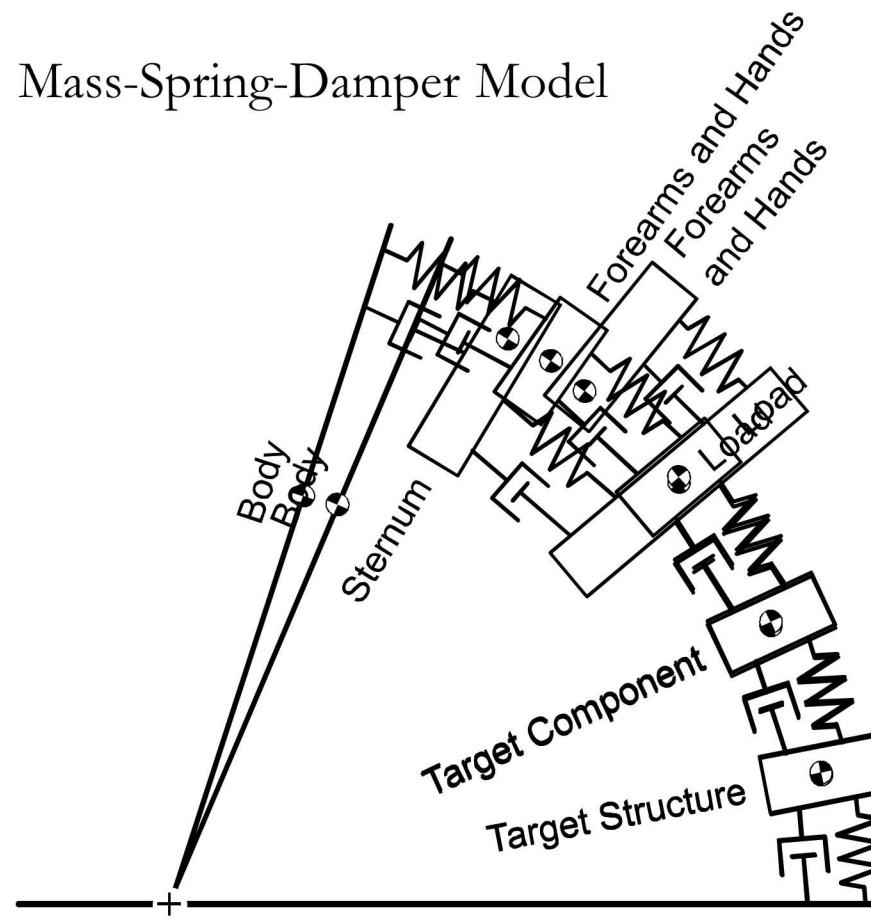
Safety, Surety, Impact, Puncture, Materials, Plasticity, Fracture, Damage Evolution, Weldments, Electrostatic Discharge, Lightning, Heat Transfer, Finite Element Analysis, Multi-physics Analysis



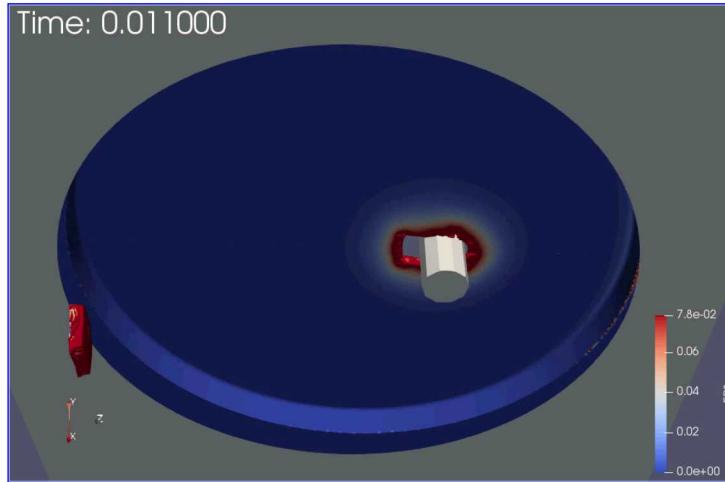
Model Human Body Impacts on Structures



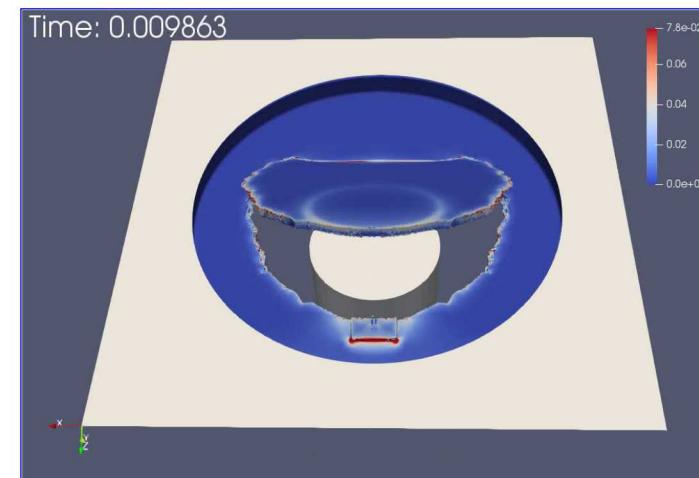
Mass-Spring-Damper Model



Validate Advanced Constitutive Models and Failure Criteria for Ductile Metals



1-Inch Cylindrical Punch
0.065 Inches of 7075-T651 Aluminum
Johnson-Cook Constitutive Model
Wellman Failure Criterion

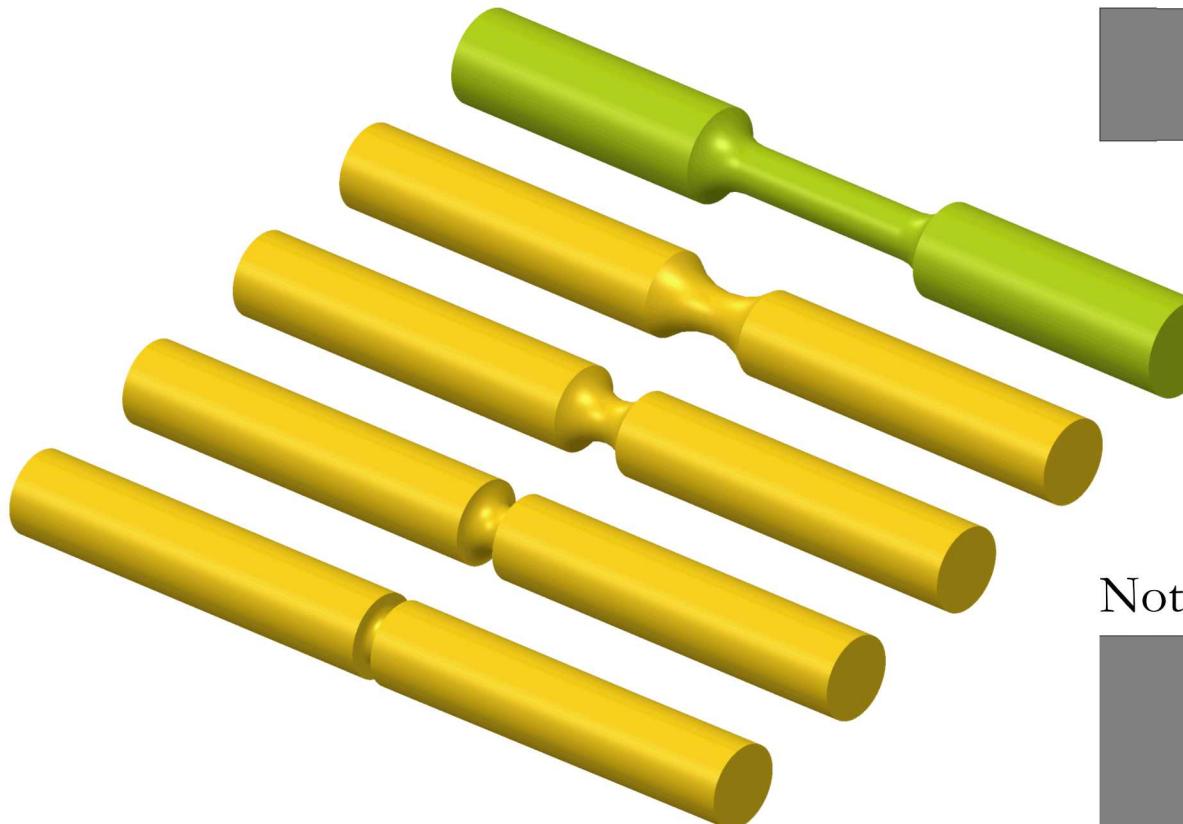


0.25-Inch Cylindrical Punch
0.065 Inches of 7075-T651 Aluminum
Johnson-Cook Constitutive Model
Strain Energy Density Failure Criterion



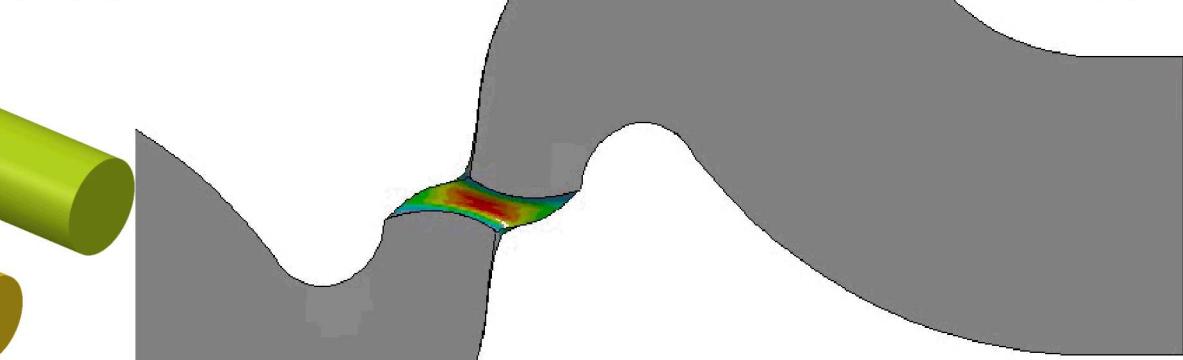
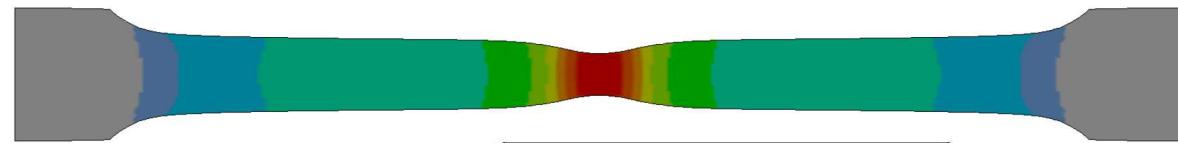
Design Specimens for Measuring Failure Criteria over a Wide Range of Triaxiality Factors

Compaction Tension and Shear

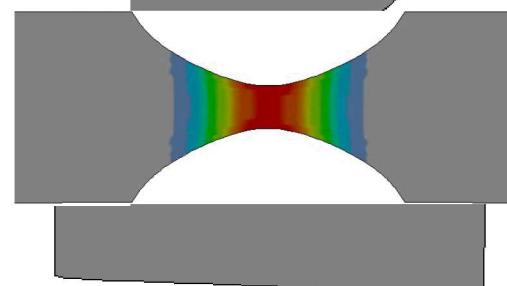


Shear

Notched Tension



Notched Tension



6 FUNDING SOURCES

Department of Energy:

- National Nuclear Security Administration



Collaboration Supporting Students:

- TAMU
- UNM



RESEARCH NEEDS

Strength tests of materials and joints

- Strength of spot weld in 304L steel
- Tension tests of 7049-T7352 aluminum
- Tension and compression tests of Tape-Wound Carbon Phenolic (TWCP)
- Bending test of TWCP on aluminum substrate

Puncture tests for various materials and thicknesses with punches of different shapes and sizes

- 6061-T651
- 304L
- 17-4PH
- 15-5PH
- TWCP

Predictive failure criteria in finite element or meshless simulations of these materials

