

Reliability calculations for ductile laser welds with stochastic reduced-order models

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Laser welds are prevalent in the systems supported by Sandia R&D efforts and they are used in many applications in the aerospace industry in general. These partial penetration welds have variable, and hence uncertain, geometry and sharp, crack-like notches at their root. Modeling these types of welds in large systems is important for predicting reliability, yet challenging because of the disparate length scales. To this end, a surrogate model, based on stochastic reduced order models (SROMs), is developed to represent the laser welds in the larger system. Here, the uncertainty in weld microstructure and geometry are captured by calibrating plasticity parameters to experimental observations of necking. The uncertainty is then propagated to the system response with the surrogate model. Implications for explicit modeling of microstructural features will be explored.

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