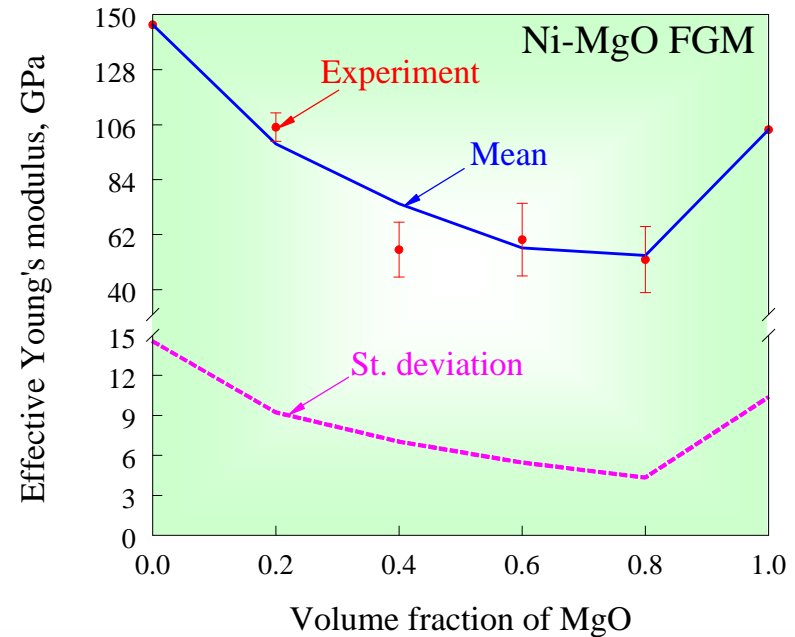
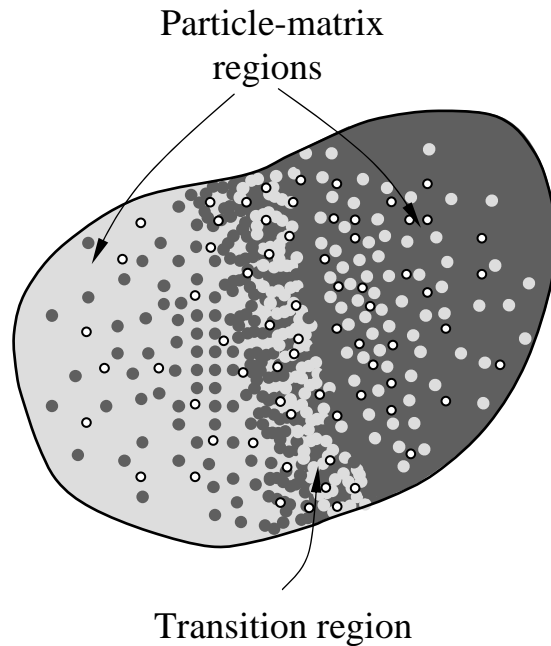




Computational Solid Mechanics

• Micromechanics of Heterogeneous Materials

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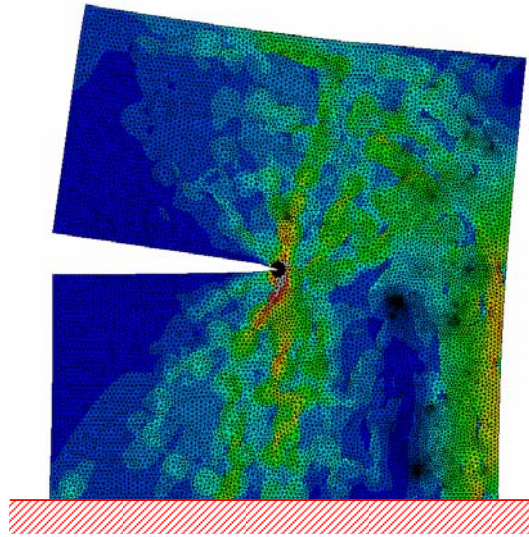
A new stochastic homogenization model involving non-Gaussian, non-homogeneous random field representations of particle volume fraction and porosity was developed for predicting statistics of effective mechanical properties of functionally graded materials (Mech. of Materials, 2007).



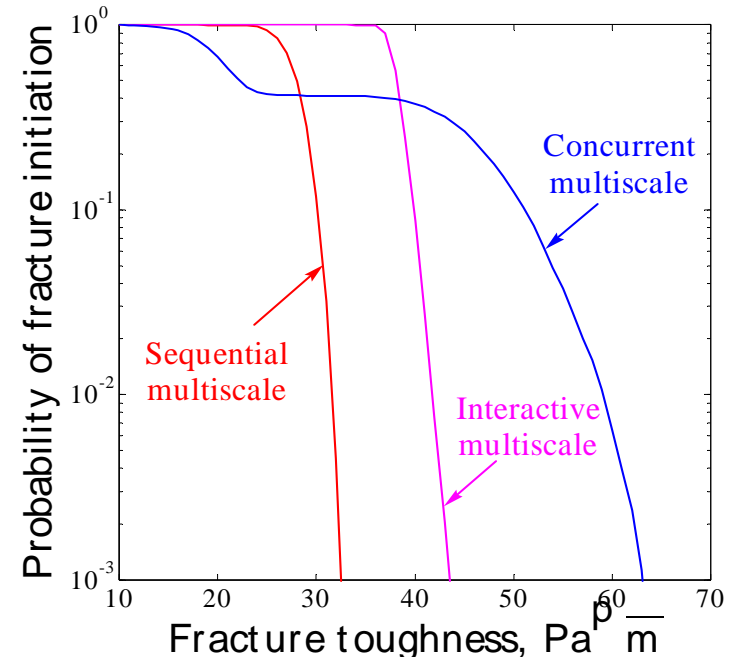
Computational Solid Mechanics

- **Multiscale Fracture of Functionally Graded Materials**

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Randomly distributed particles in a matrix subject to mixed-mode fracture



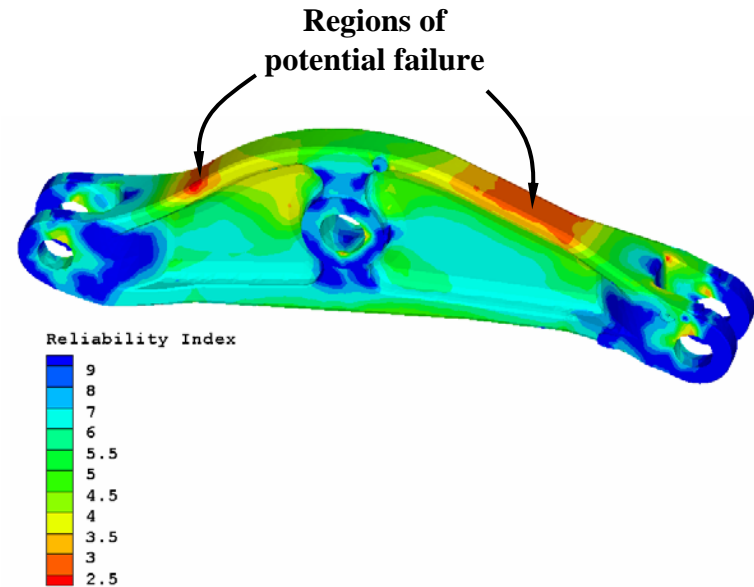
A new concurrent multiscale model comprising micro- and macro-scale fracture analyses of functionally graded materials was developed. Results show that sequential or interactive multiscale analyses may produce misleading estimates of crack-driving force (EFM, 2007).



Computational Stochastic Mechanics

- **Fatigue Durability & Reliability**

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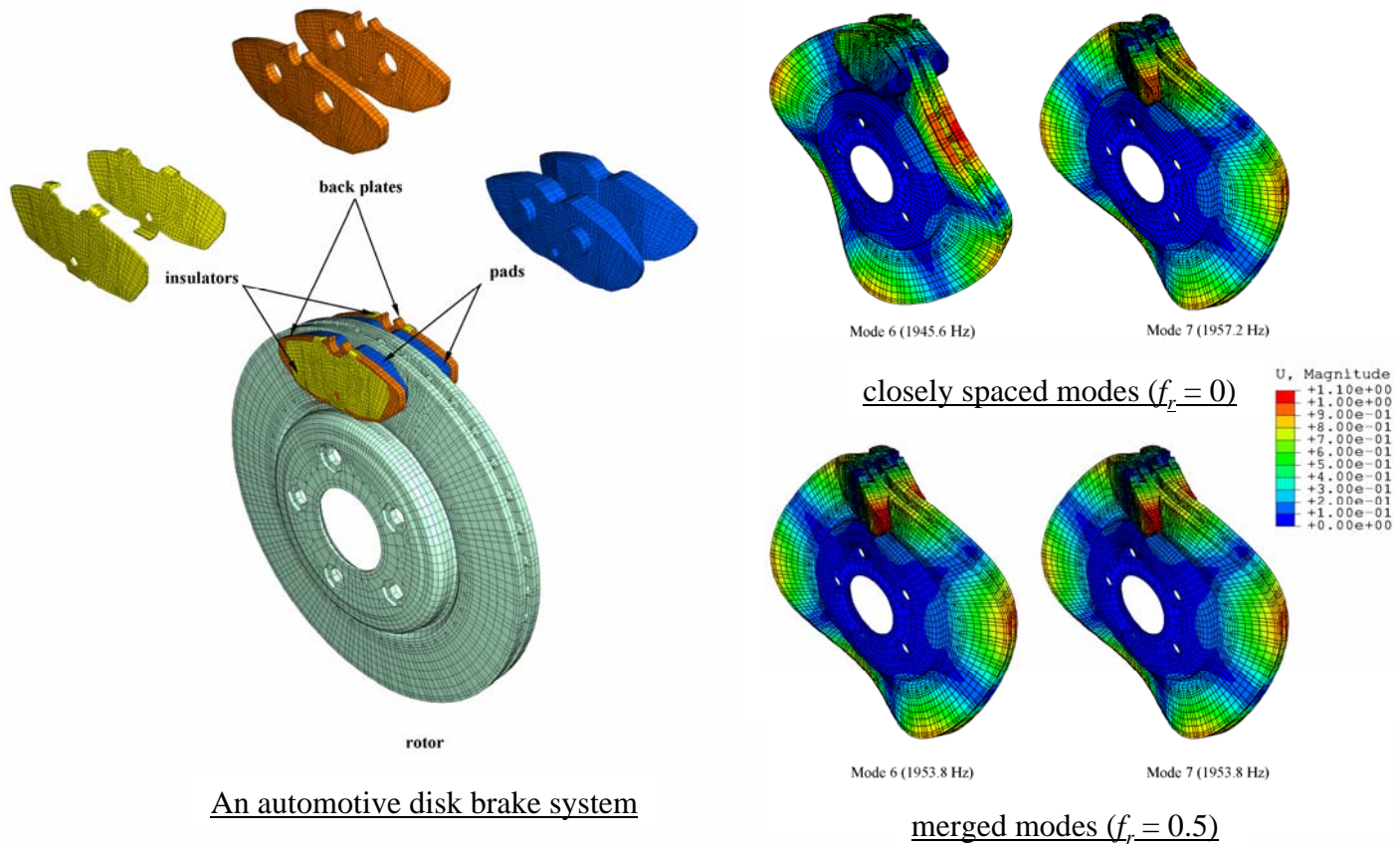
New dimension-reduction methods were developed for conducting fatigue reliability analysis of an existing design of a lever arm, identifying regions where failure is most likely to occur. New methods from this work will aid in improved design of the lever arm (PEM, 2006).



Computational Stochastic Mechanics

- Random Eigenvalue Problems

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An automotive disk brake system

merged modes ($f_r = 0.5$)

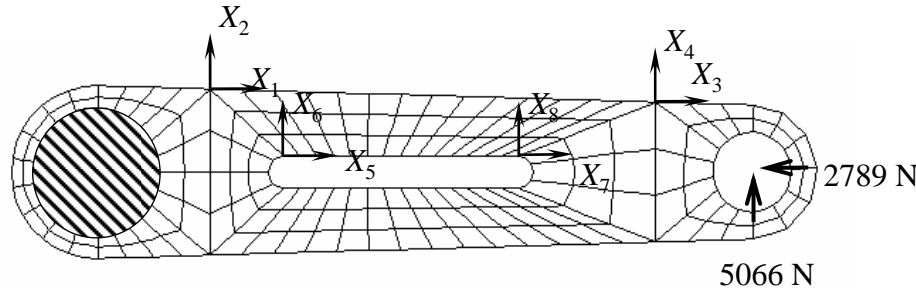
New decomposition methods were developed for solving random eigenvalue problems, thereby predicting the probability of dynamic instability. Results from this work will minimize squeal probability of a disc brake system (IJNME,2007).



Computational Stochastic Mechanics

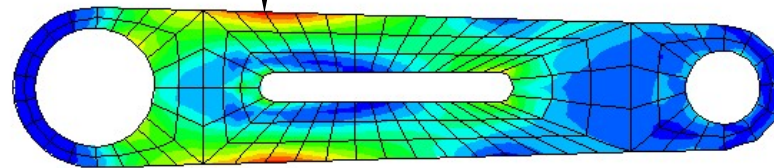
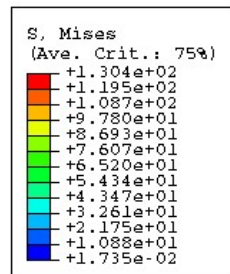
• Stochastic Shape Design Optimization

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Initial design of a torque arm; X_i , $i = 1, 8$ are shape design parameters

Maximum von Mises stress at node 98

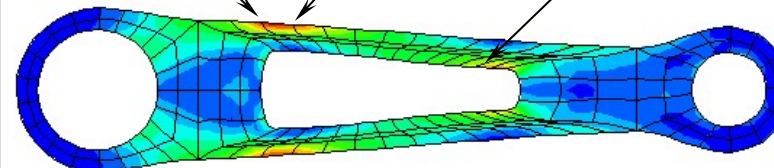
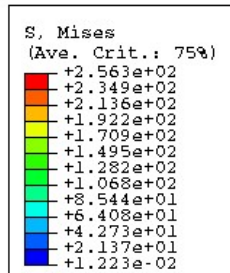


Contour of von Mises stress at initial design

node 106: 247 MPa

node 98: 256 MPa

node 173: 226 MPa



Contour of von Mises stress at reliability-based optimal design (SMO, 2007).