Stochastic Analysis of Structures in Fire by Monte Carlo Simulation

Kaihang Shi, Qianru Guo, and Ann Jeffers*

Dept of Civil and Environmental Engineering
University of Michigan
Ann Arbor, MI USA

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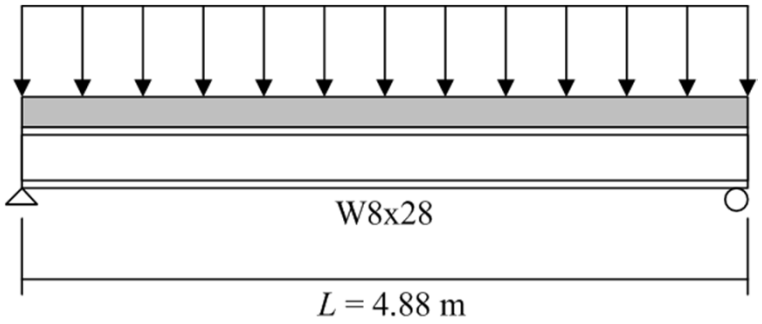
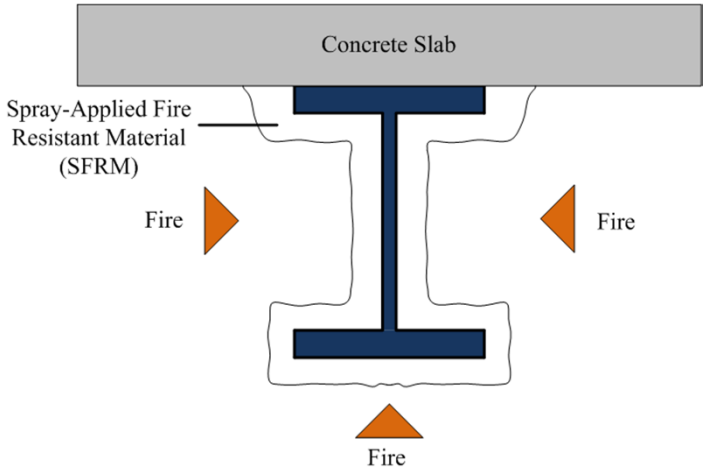
Application: Stochastic Simulation of Protected Steel Beam



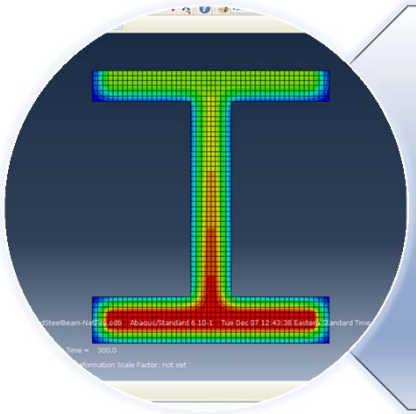


Reliability-based framework:

1. Characterize the sources of uncertainty
2. Quantify the probabilistic characteristics of each uncertain parameter
3. Define performance criteria for the structure based on strength, stability, and serviceability requirements
4. Evaluate the structural response stochastically by Monte Carlo simulation
5. Calculate the probability of failure

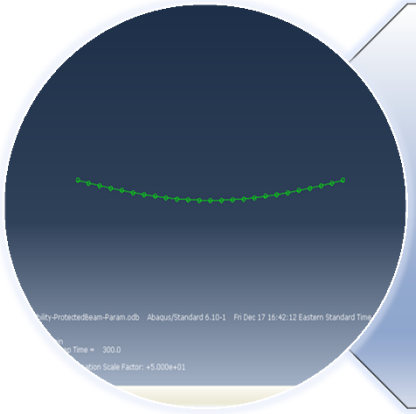
$$p_f = \frac{N_f}{N}$$

Stochastic Finite Element Simulation in Abaqus



Stochastic Heat Transfer Analysis

- ***Input:***
  - 1 Python script file (.psf)
  - 1 Parametric input file (.inp)
- ***Output:***
  - *N* Output database files (.odb)

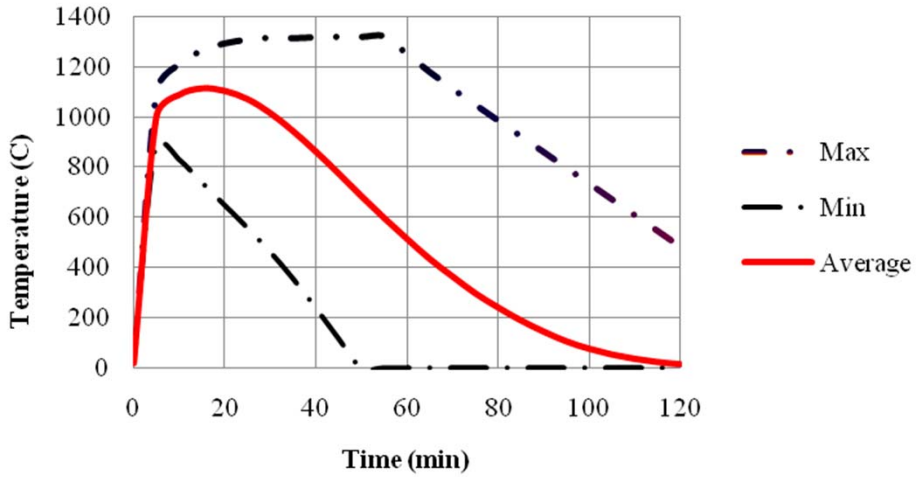


Stochastic Structural Analysis

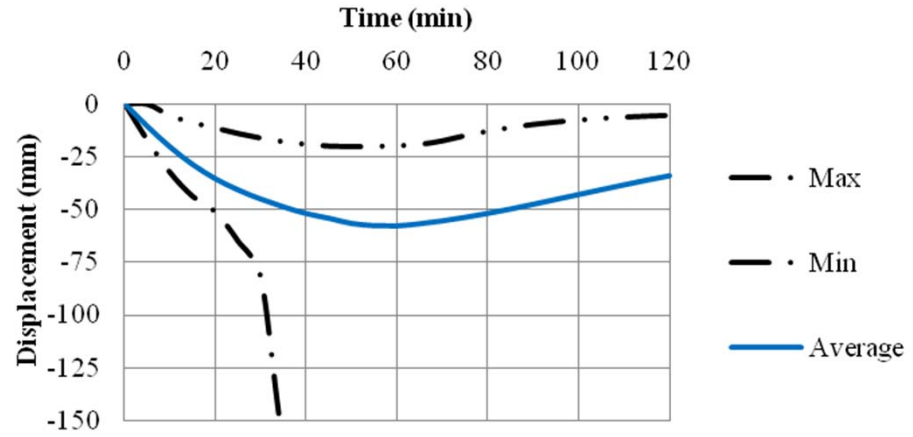
- ***Input:***
  - 1 Python script file (.psf)
  - 1 Parametric input file (.inp)
- ***Output:***
  - *N* Output database files (.odb)

Results and Conclusions

Fire temperature



Deformation response



Failure: Beam deflection exceeds $L/30$ = 162mm

Probability of Failure: p_f = 1.3%