Stress Concentration or Singularity

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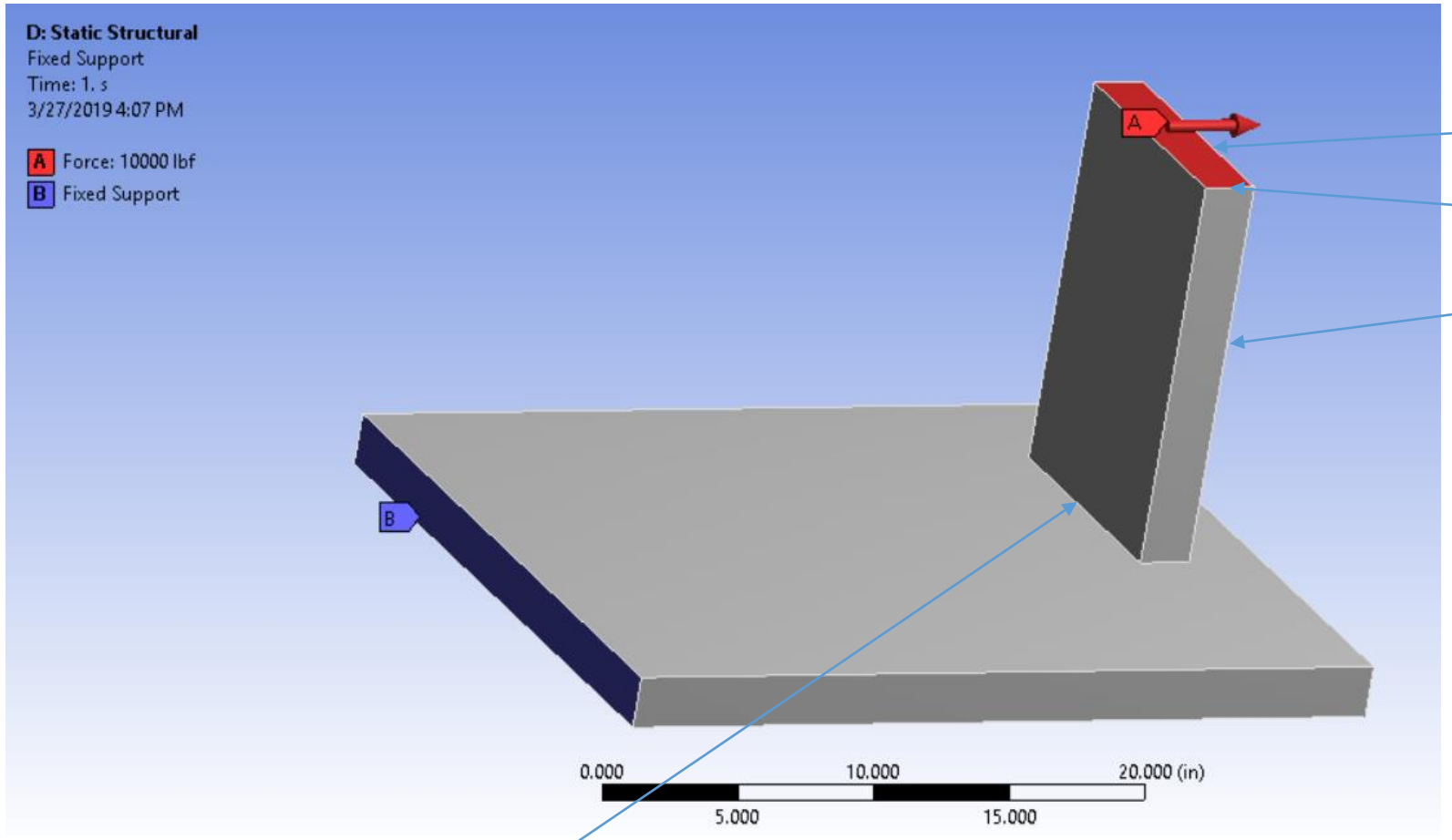
- Static Linear Analysis never converges at the stress concentration area or singularity.

- For linear elastic analysis, the finer the mesh, the higher the stress in the singularity.

Problem Setup



B=10 in

H=2.0 in

L=15 in

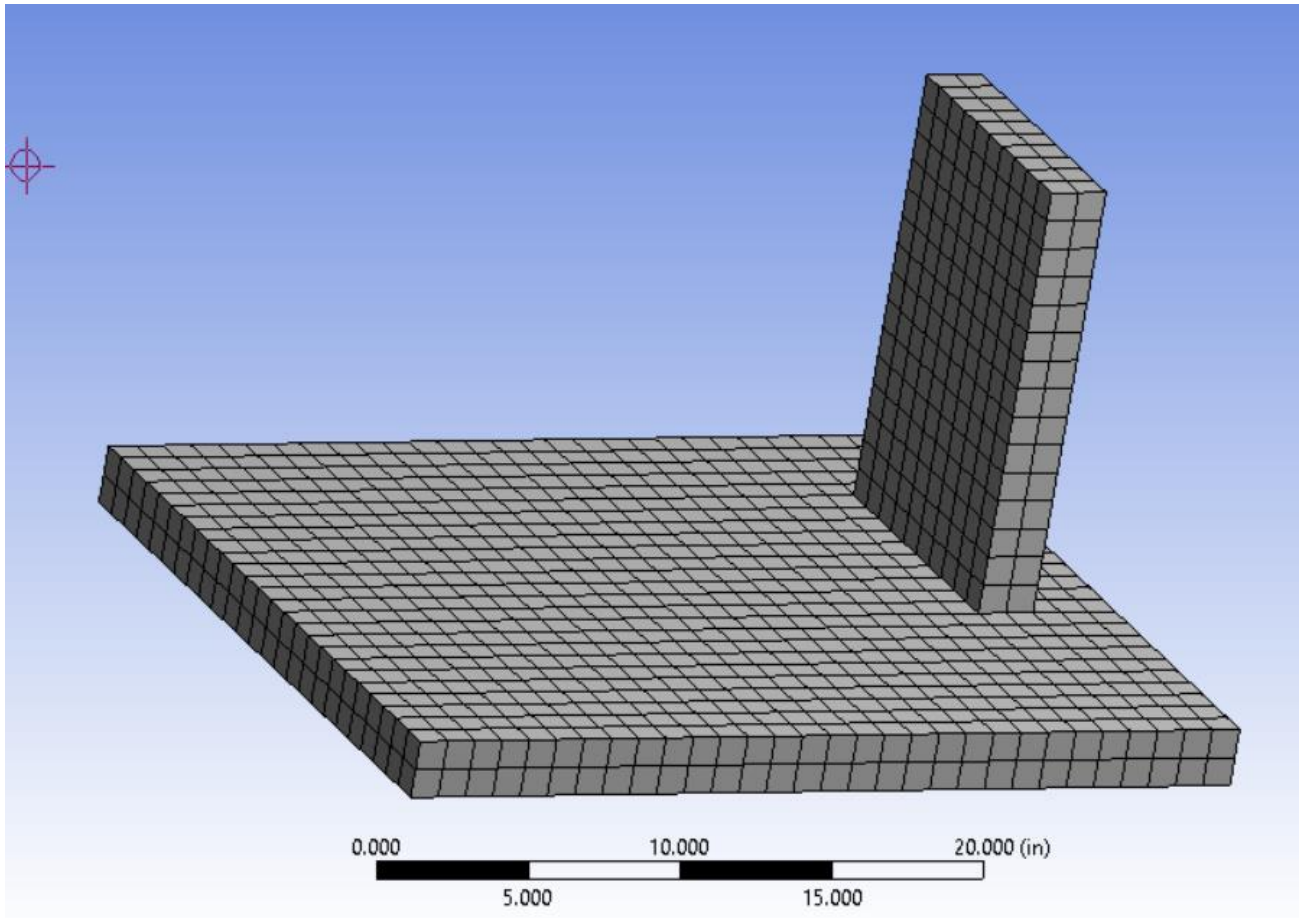
I = 6.667 in^4

M = 10000 lbf*15 in

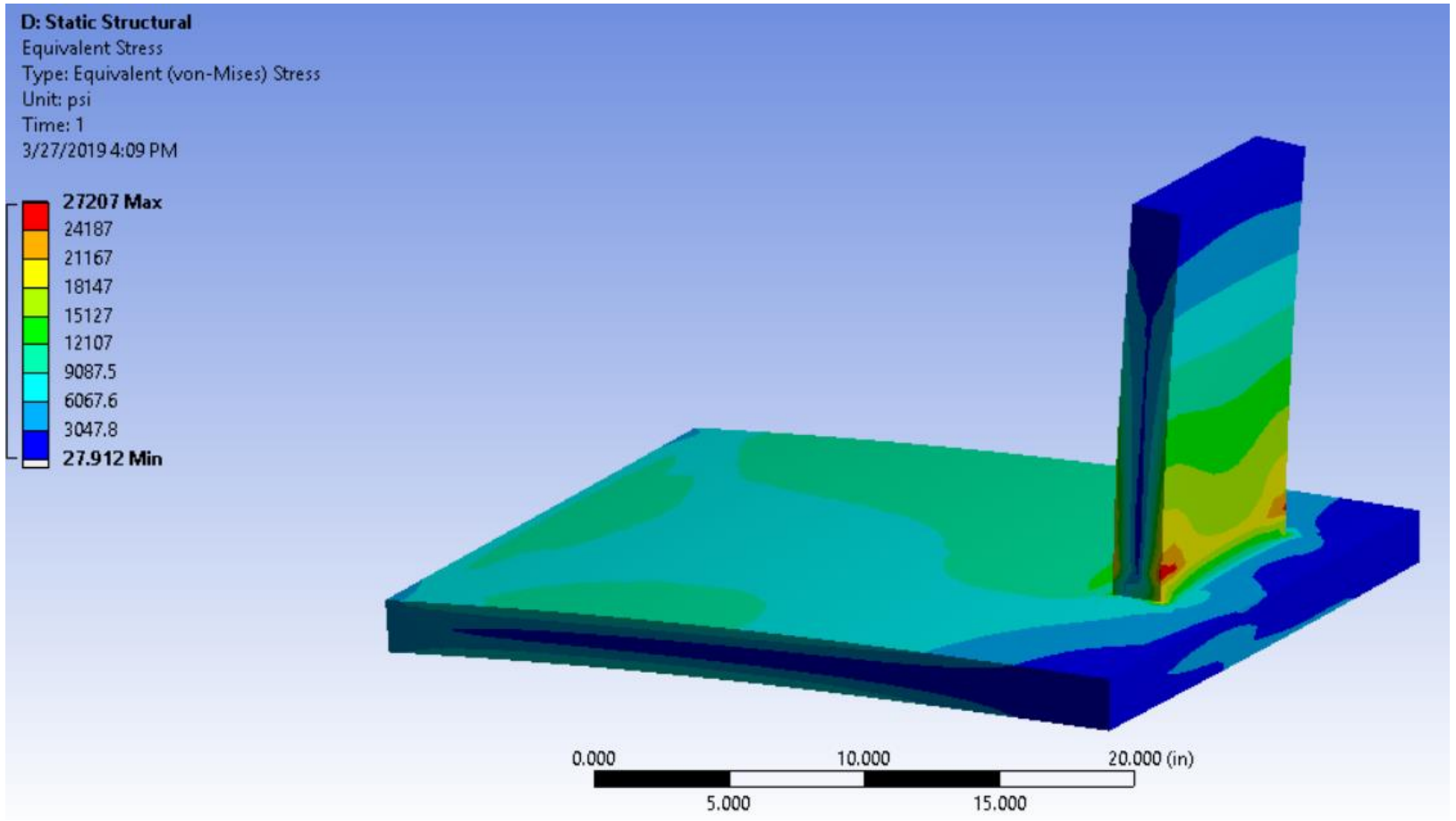
c = 0.5*H=1.0 in

Bending stress = Mc/I = 22.5 ksi

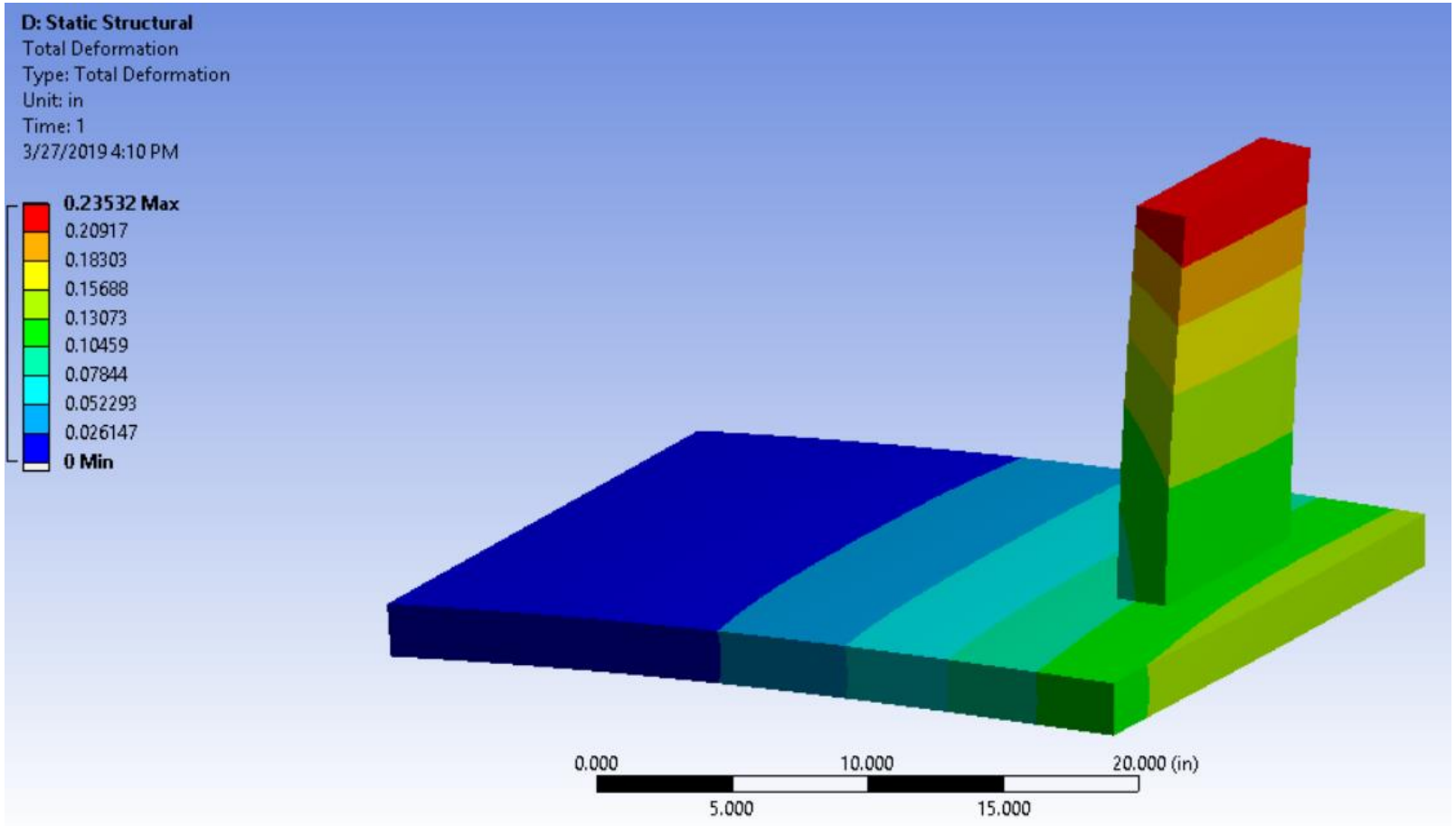
Mesh Size = 1.0 in



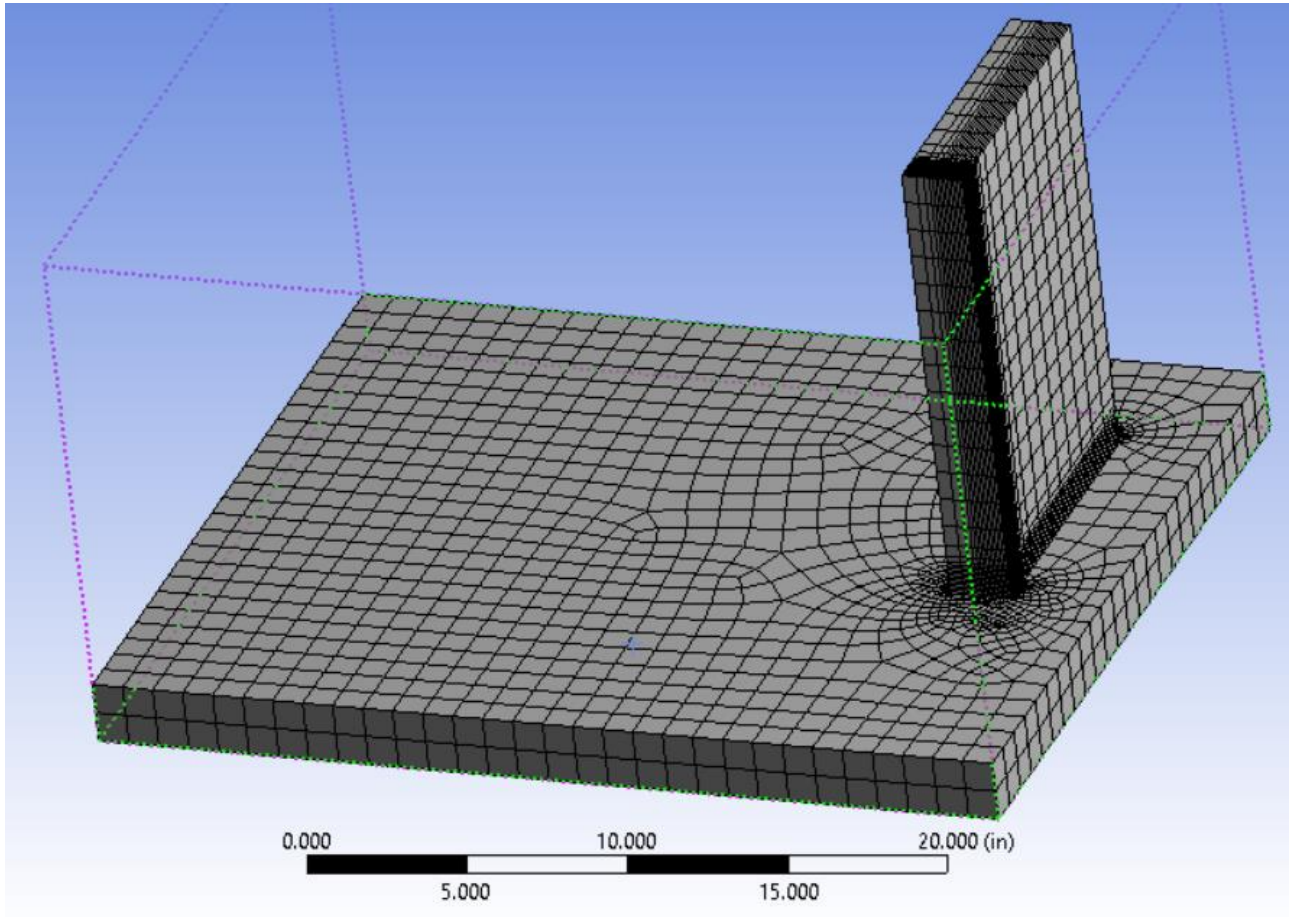
Max von Mises stress = 27.2 ksi



Displacement = 0.235 in

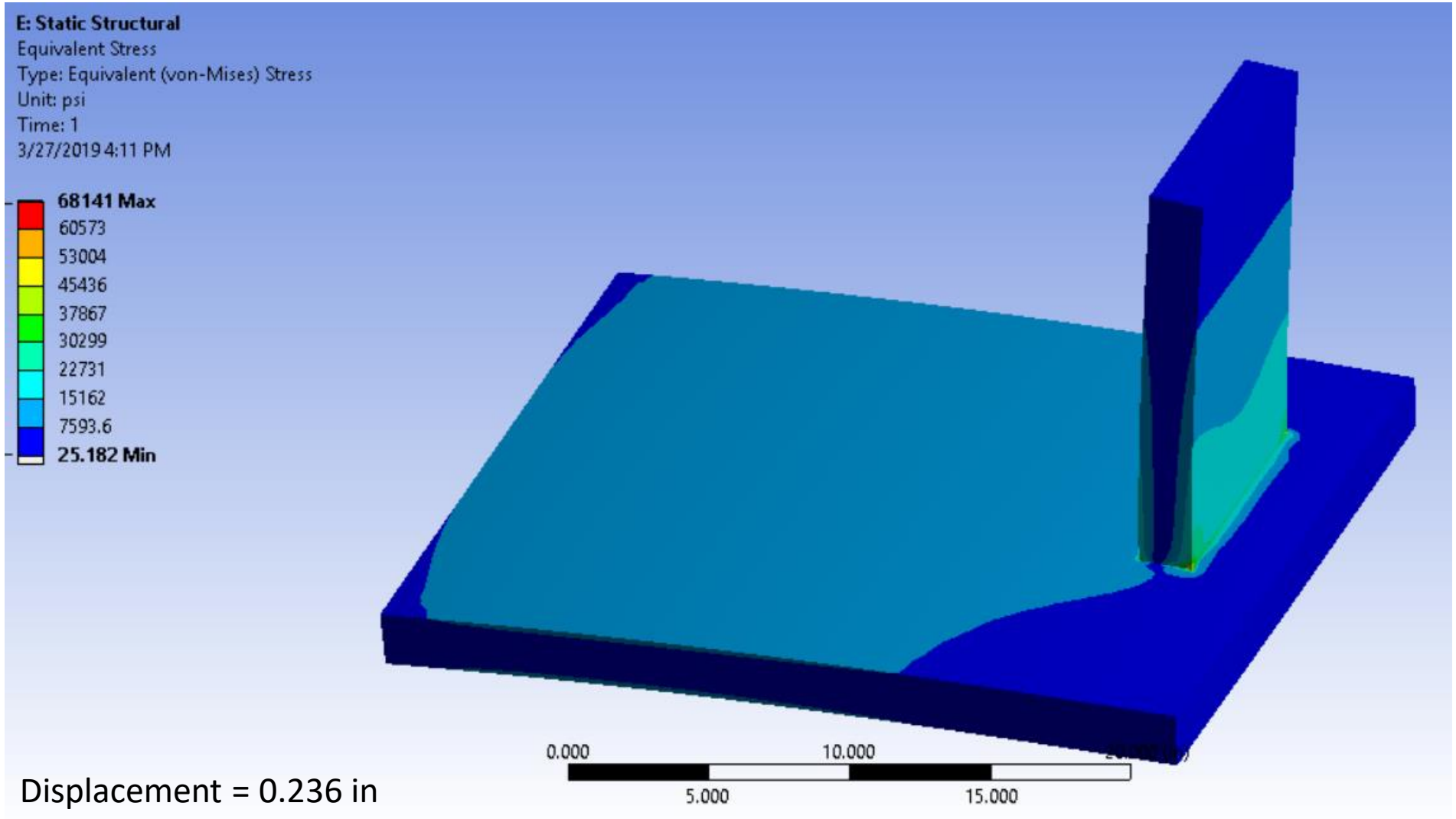


Min Mesh size = 0.1 in



Max von Mises stress (0.1’’ mesh size) = 68.1 ksi

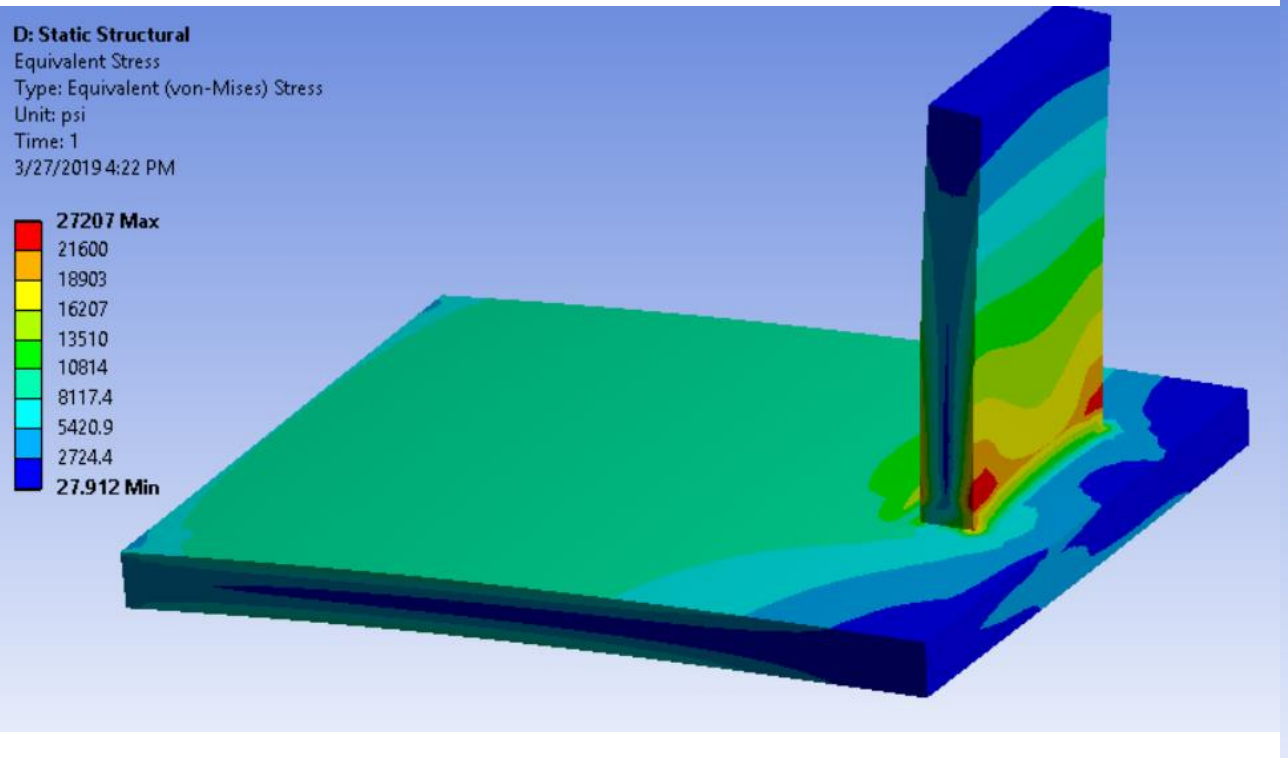
Max von Mises stress (1.0’’ mesh size) = 27.2 ksi



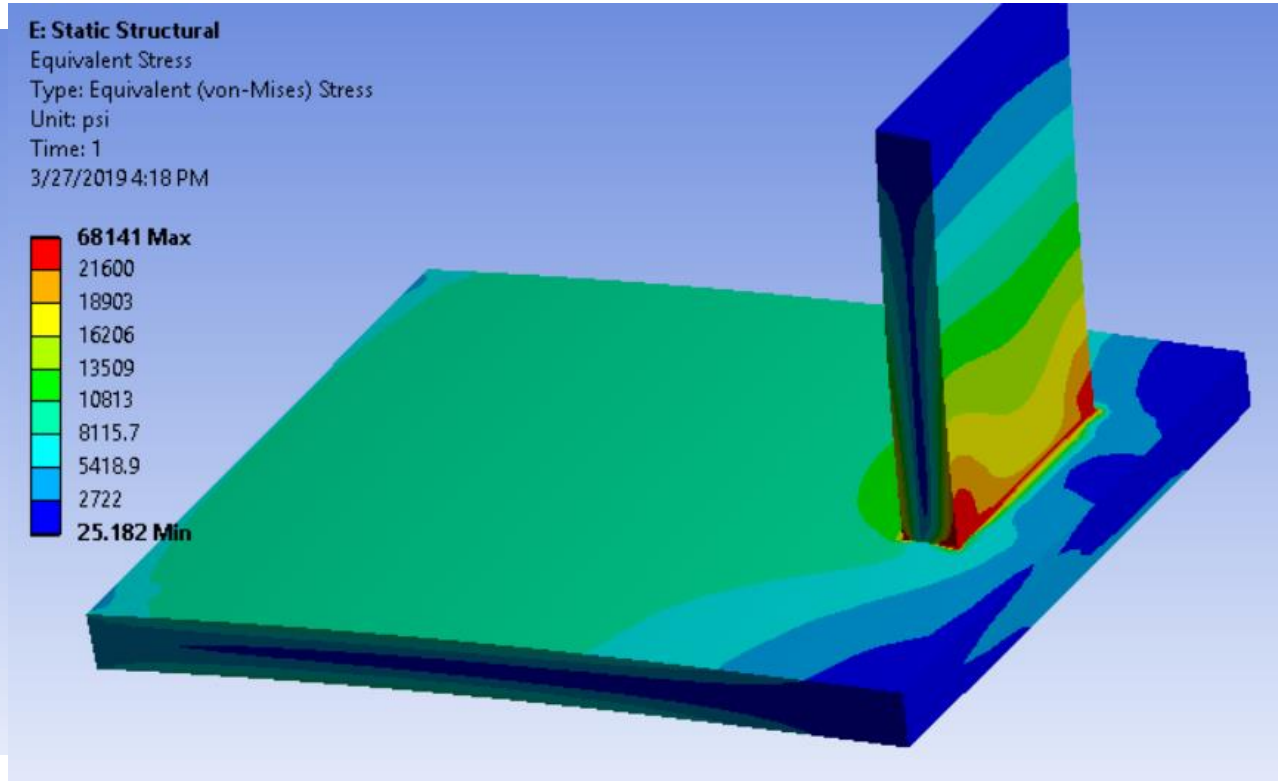
Displacement = 0.236 in

Area with stress > 21.6 ksi

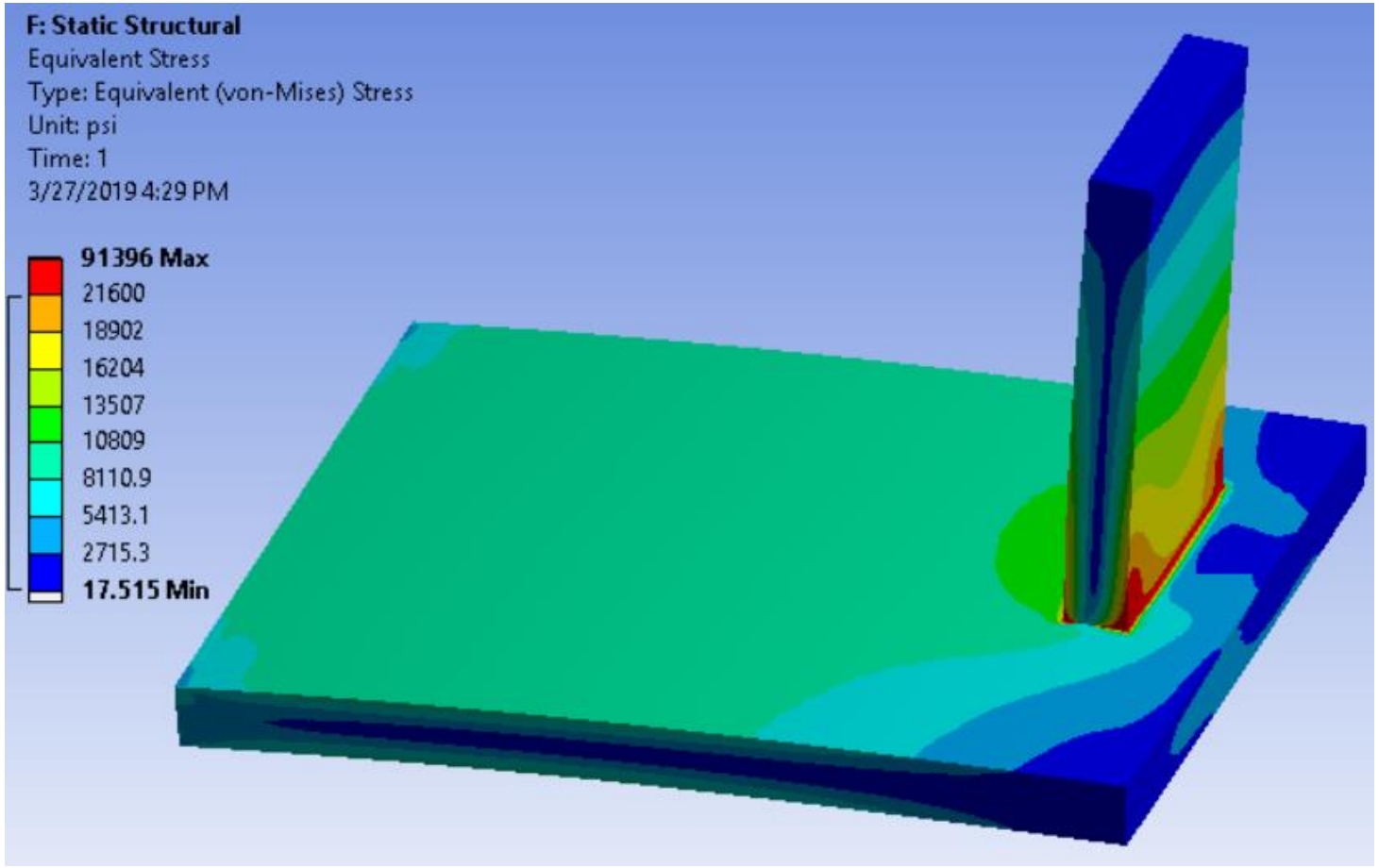
Mesh = 1.0’’



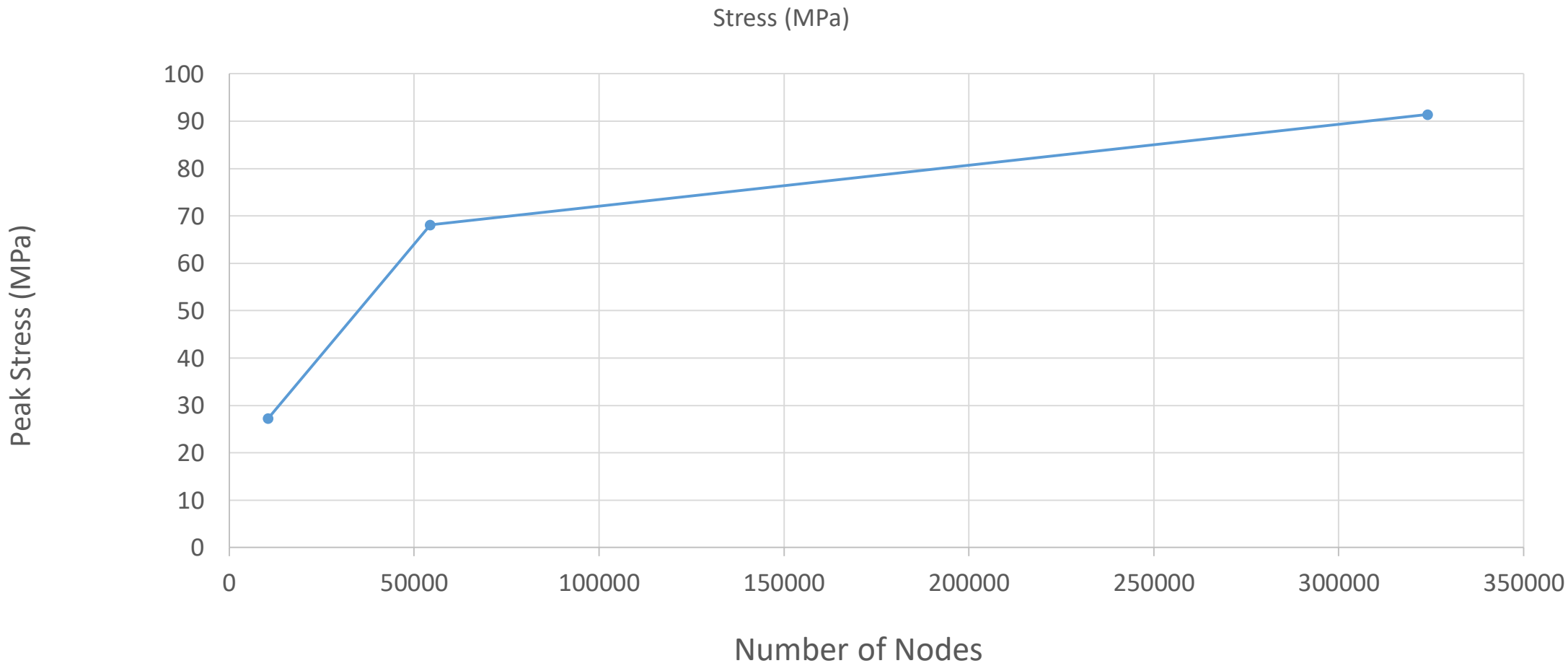
Mesh = 0.1’’



Mesh = 0.05’’; Max = 91.4 ksi; Displacement = 0.237 in

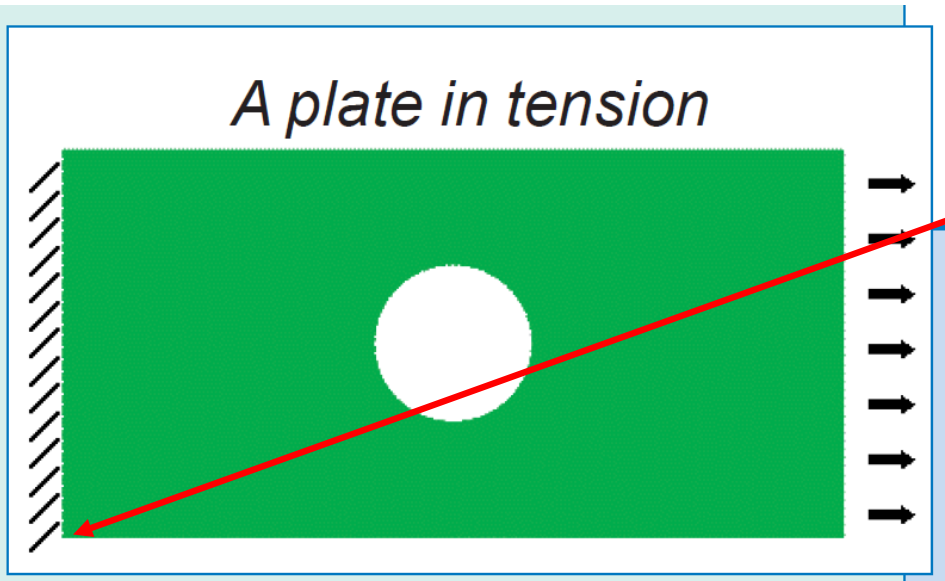


Peak Stress vs Number of Nodes



It looks like the stress is converging; but this is not true!

Stress at the corner never converges



The tensile strip with a hole looks innocent enough. It's 200 × 100 mm, and 10 mm thick. The hole is 40 mm diameter. Load is 100,000 N in tension and the material has a modulus of 200,000 MPa and Poisson's ration of 0.27. Results are in following images.