

Motovated Design & Analysis, Ltd.

MathCAD Stress Analysis

Client: Canterbury University

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Analysis Title: Re-Entrant review for Comp Solids Course

Initial Analyst: Greg Morehouse Date: 12 Oct 09

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MOTOVATED
DESIGN & ANALYSIS

N := newton

kN := $10^3 \cdot$ newton

kPa := $10^3 \cdot$ Pa

MPa := $10^6 \cdot$ Pa

GPa := $10^9 \cdot$ Pa

ksi := $10^3 \cdot$ psi

bar := 100 · kPa

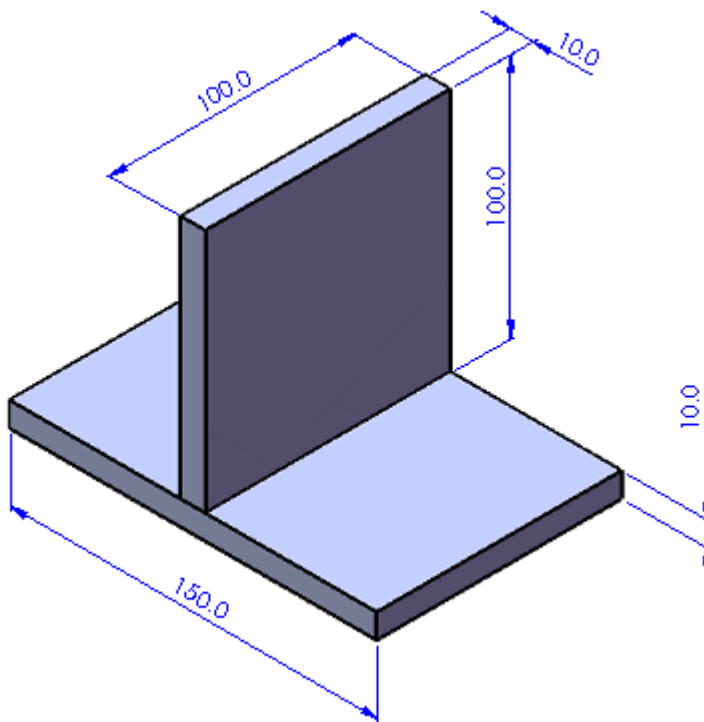
rev := 360 · deg

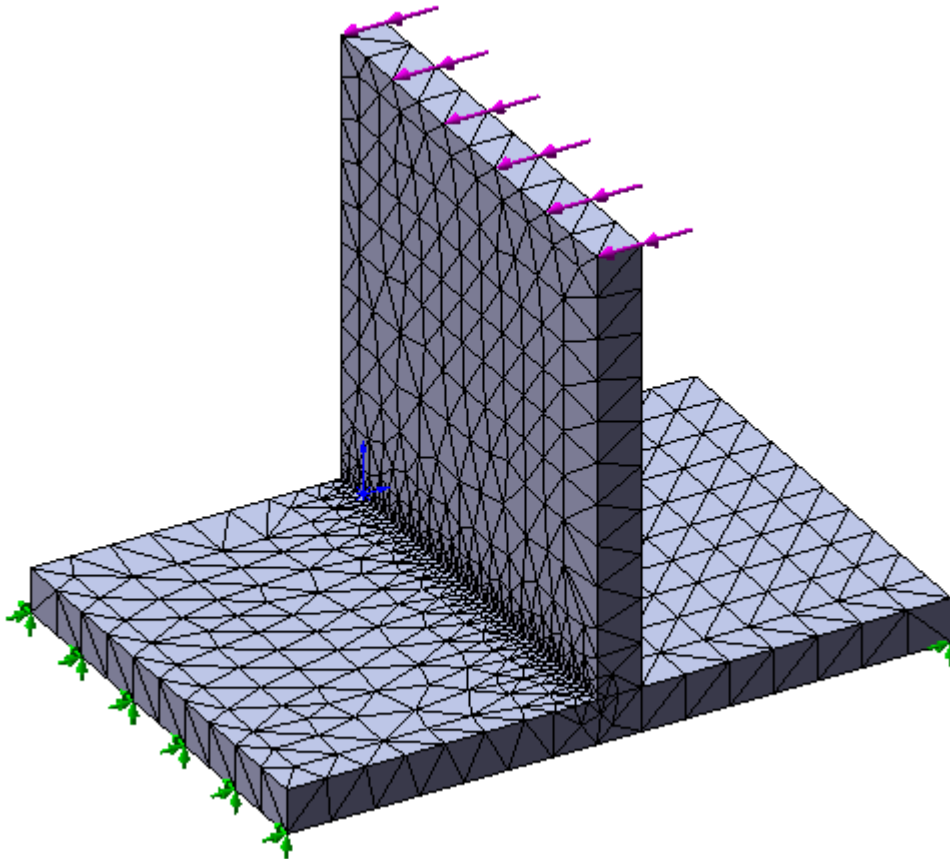
Hz := $2 \cdot \pi \cdot \frac{\text{rad}}{\text{sec}}$

$\frac{\text{rev}}{\text{sec}} = 1.0 \cdot \text{Hz}$

Review re-entrant issues on simple bracket:

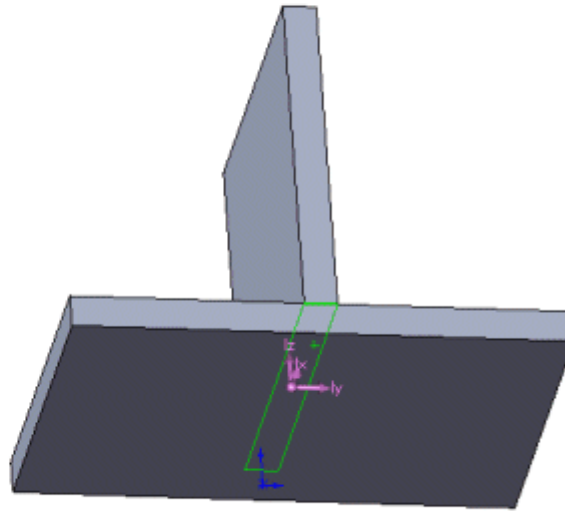
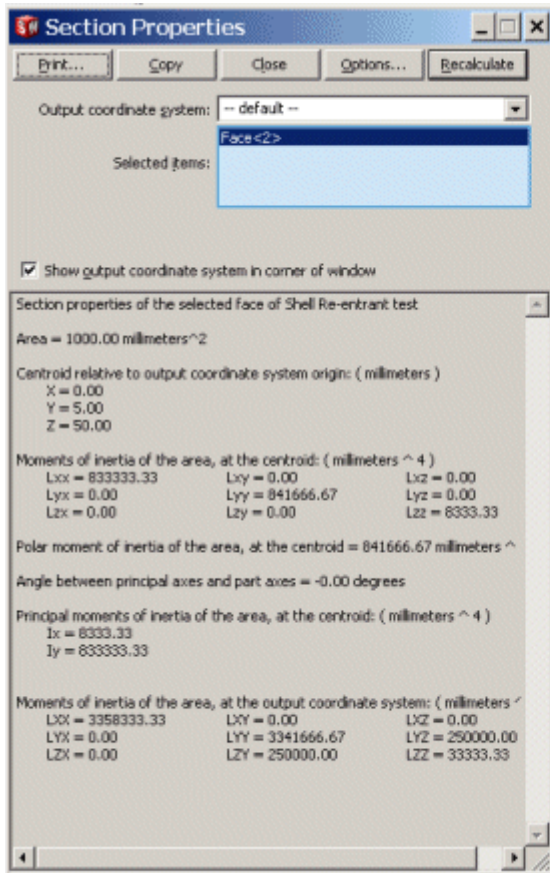
Problem Statement: Bracket as shown below from 10mm plate, 1000 N applied perpendicular to the vertical plate. Simply supported boundary conditions are applied on the horizontal plate (left and right edges)





Mesh Images with 10mm global mesh, 2 mm refinement in LH corner.

Derive the expected stresses:



$$I_x := 8333.33 \cdot \text{mm}^4$$

$$C_x := 5 \cdot \text{mm}$$

$$S_x := \frac{I_x}{C_x}$$

$$S_x = 1666.7 \cdot \text{mm}^3$$

$$M_x := 1000 \cdot \text{N} \cdot 100 \cdot \text{mm}$$

$$M_x = 100.0 \cdot \text{N} \cdot \text{m}$$

$$\sigma_{\max} := \frac{M_x}{S_x}$$

$$\sigma_{\max} = 60.0 \cdot \text{MPa}$$

FE Stresses depending upon refinement:

Mesh Refinement (mm)	10	5	2	1	0.5
Indicated Stress (MPa)	53.2	53.5	71.1	82.2	104.1

Note that the stress is not converging! Also note it under-estimates initially, and over-estimates after a couple of refinements. So where is the exact stress? What does this imply from a weld analysis point of view?

