15 (cont'd) c) principals from (a)

$\hat{\sigma}, \check{\sigma}$	1/n from (10)	n
200, 0	$\max\left(\frac{200}{250}, 0, \frac{200}{250} - \frac{200}{800}\right) = 0.8$	1.25
50, −340	$\max\left(\frac{50}{250}, \frac{340}{800}, \frac{50}{250} + \frac{290}{800}\right) = 0.56$	1.78
0, −450	$\max\left(0, \frac{450}{800}, 0 + \frac{450}{800}\right) = 0.56$	1.78

d) principals from (b) with $\nu = 0.2$

principals	1/n from (10)	n
200, 50, 50	$\max\left(\frac{200}{250}, \frac{-50}{800}, \frac{200}{250} - \frac{250}{800}\right) = 0.8$	1.25
50, −58, −340	$\max\left(\frac{50}{250}, \frac{340}{800}, \frac{50}{250} + \frac{340}{800}\right) = 0.56$	1.78
−130, −200, −450	$\max\left(\frac{-130}{250}, \frac{450}{800}, \frac{-130}{250} + \frac{800}{800}\right) = 0.56$	1.78

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From (8) with $\sigma_3 = 0$

$$\sigma_E^2 = \tfrac{1}{2}\left[(\sigma_1 - \sigma_2)^2 + \sigma_1^2 + \sigma_2^2\right]$$

$$= \sigma_1^2 - \sigma_1\sigma_2 + \sigma_2^2$$

If $\sigma_1 = \bar{\sigma} + \tilde{\sigma}$, $\sigma_2 = \bar{\sigma} - \tilde{\sigma}$

$\sigma_E^2 = \bar{\sigma}^2 + 3\tilde{\sigma}^2$

If $\bar{\sigma} = (\sigma_x + \sigma_y)/2$

$\tilde{\sigma}^2 = \left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2$

$\sigma_E^2 = \sigma_x^2 - \sigma_x\sigma_y + \sigma_y^2 + 3\tau_{xy}^2$

QED.

The first equation is plotted :-

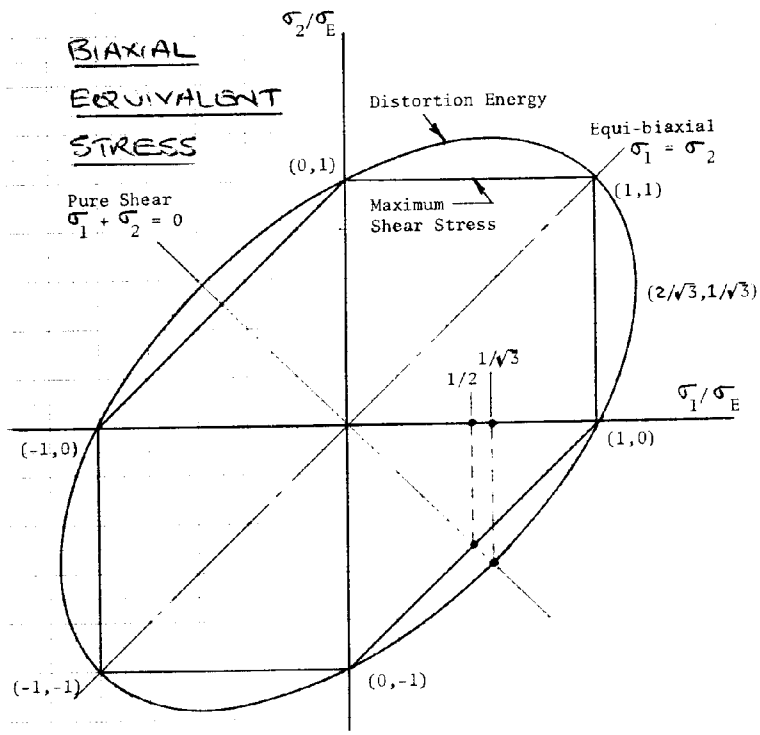
For pure shear, $\sigma_2 = -\sigma_1$ so from first equation

$\sigma_E^2 = 3\sigma_1^2$

Or, at failure ($n = 1$)

$S = \sqrt{3}\, S_{shear}$

i.e. $S_s/S = 1/\sqrt{3} = 0.577$



For the maximum shear stress theory applied to plane stress ($\sigma_3 = 0$).

From (9) if $\sigma_1 \geq \sigma_2 \geq 0$ then $\hat{\sigma} = \sigma_1$; $\check{\sigma} = 0$ & $\sigma_E = \sigma_1$

if $\sigma_1 \geq 0 \geq \sigma_2$ then $\hat{\sigma} = \sigma_1$; $\check{\sigma} = \sigma_2$ & $\sigma_E = \sigma_1 - \sigma_2$

which plot as straight lines in first quadrant (under the equality-line) and fourth quadrant. Considering other inequality cases of $(\sigma_1, \sigma_2, 0)$ leads to complete failure locus as shown.

Again we note that the max. shear stress theory is more conservative than the distortion energy theory.