Exam 1 Equation Sheet

Stress intensity factors

General Form

$$K_I = \sigma\sqrt{\pi a}\beta \tag{1}$$

Infinitely wide, center crack

$$\beta = 1 \tag{2}$$

Finite width correction, center crack

$$\beta = \sqrt{\sec(\pi a/W)} \tag{3}$$

Infinitely wide, edge crack

$$\beta = 1.122 \tag{4}$$

Finite width correction, edge crack

$$\beta = \left[1.122 - 0.231\frac{a}{W} + 10.55\left(\frac{a}{W}\right)^2 - 21.71\left(\frac{a}{W}\right)^3 + 30.82\left(\frac{a}{W}\right)^4\right] \tag{5}$$

Edge crack, bending moment

Nominal stress

$$\sigma = \frac{6M}{tW^2} = \frac{My}{I}$$

$$\beta = \left[1.122 - 1.40\frac{a}{W} + 7.33\left(\frac{a}{W}\right)^2 - 13.08\left(\frac{a}{W}\right)^3 + 14.0\left(\frac{a}{W}\right)^4\right] \tag{6}$$

Splitting forces

$$K_I = \frac{P}{t\sqrt{\pi a}}\beta \tag{7}$$

Plastic Zone

$$r_p = \frac{1}{I\pi}\left(\frac{K_I}{\sigma_{YS}}\right)^2 \tag{8}$$

$$I = 6.7 - \frac{1.5}{t}\left(\frac{K_I}{\sigma_{YS}}\right)^2 \tag{9}$$

$$2 < I < 6 \tag{10}$$