

## FORMELSAMLING UTMATTNING

$$R = \frac{\sigma_{\min}}{\sigma_{\max}}$$

Basquins samband  $\sigma_a = \frac{\Delta\sigma}{2} = \sigma_f' (2N_f)^b$

Morrows samband (Modifierad Basquin)  $\sigma_a = \frac{\Delta\sigma}{2} = (\sigma_f' - \sigma_m)(2N_f)^b$

Soderberg  $\sigma_a = \sigma_a|_{\sigma_m=0} \left(1 - \frac{\sigma_m}{\sigma_Y}\right)$

Modifierad Goodman  $\sigma_a = \sigma_a|_{\sigma_m=0} \left(1 - \frac{\sigma_m}{\sigma_{TS}}\right)$

Gerber  $\sigma_a = \sigma_a|_{\sigma_m=0} \left(1 - \left(\frac{\sigma_m}{\sigma_{TS}}\right)^2\right)$

Palmgren-Miner  $\sum_{i=1}^m \frac{n_i}{N_{fi}} = 1$

Anvisningsfaktorn  $K_f = 1 + q(K_t - 1)$

Kombination av anvisning och  $\sigma_m \neq 0$ ; modifierad Goodman  $S_a = \frac{S_a|_{\sigma_m=0}}{K_f} \left(1 - \frac{\sigma_m}{\sigma_{TS}/K_f}\right)$

Ramberg-Osgood, monoton lastpåläggning

$$\varepsilon = \varepsilon_e + \varepsilon_p = \frac{\sigma}{E} + \varepsilon_f \left(\frac{\sigma}{\sigma_f}\right)^{1/n} = \frac{\sigma}{E} + \left(\frac{\sigma}{A}\right)^{1/n}$$

Ramberg-Osgood, cyklisk last

$$\varepsilon_a = \varepsilon_{a,e} + \varepsilon_{a,p} = \frac{\sigma_a}{E} + \varepsilon_f' \left(\frac{\sigma_a}{\sigma_f'}\right)^{1/n'} = \frac{\sigma_a}{E} + \left(\frac{\sigma_a}{A'}\right)^{1/n'}$$

$$\Delta\varepsilon = \Delta\varepsilon_e + \Delta\varepsilon_p = \frac{\Delta\sigma}{E} + 2\varepsilon_f' \left(\frac{\Delta\sigma}{2\sigma_f'}\right)^{1/n'} = \frac{\Delta\sigma}{E} + 2\left(\frac{\Delta\sigma}{2A'}\right)^{1/n'}$$

Coffin-Manson  $\frac{\Delta\varepsilon_p}{2} = \varepsilon_f' (2N_f)^c$

Morrow  $\varepsilon_a = \frac{\Delta\varepsilon}{2} = \frac{\sigma_f' - \sigma_m}{E} (2N_f)^b + \varepsilon_f' (2N_f)^c$

Neuberanalys

$$K_\sigma = \frac{\sigma_{\max}}{\sigma_\infty}$$

$$K_\varepsilon = \frac{\varepsilon_{\max}}{\varepsilon_\infty}$$

$$K_f^2 = K_\sigma K_\varepsilon$$

$$\sigma \varepsilon = \frac{K_f^2 \sigma_\infty^2}{E}$$

Griffith  $\sigma_f = \sqrt{\frac{2E' \gamma_s}{\pi a}}$ ,  $E' = E$  vid plan spänning,  $E' = \frac{E}{1-\nu^2}$  vid plan töjning

Energifrigörelsen

$$G = -\frac{dW_p}{dA} = \frac{F^2}{2} \frac{dC}{dA} = 2\gamma_s$$

$$G = \frac{1-\nu^2}{E} (K_I^2 + K_{II}^2) + \frac{1+\nu}{E} K_{III}^2, \text{ plan töjning och ut-ur planet deformation}$$

$$G = \frac{1}{E} (K_I^2 + K_{II}^2), \text{ plan spänning}$$

$$\text{ASTM: } a, W - a, B \geq \frac{25}{3\pi} \left( \frac{K_{Ic}}{\sigma_Y} \right)^2$$

Paris

$$\frac{da}{dN} = C (\Delta K_I)^m$$

$$N = \frac{1}{C (\Delta \sigma_\infty \sqrt{\pi} f(a_0))^m} \frac{a_1^{\frac{m}{2}+1} - a_0^{\frac{m}{2}+1}}{-\frac{m}{2} + 1}, \quad m \neq 2$$

$$N = \frac{1}{C (\Delta \sigma_\infty \sqrt{\pi} f(a_0))^m} \ln \frac{a_1}{a_0}, \quad m = 2$$

Irwin

$$r_p = \frac{1}{3\pi} \left( \frac{K_I}{\sigma_Y} \right)^2, \text{ plan töjning}$$

$$r_p = \frac{1}{\pi} \left( \frac{K_I}{\sigma_Y} \right)^2, \text{ plan spänning}$$

$$\text{Dugdale } r_p = a \left( \sec \frac{\pi \sigma_\infty}{2\sigma_Y} - 1 \right) \approx \frac{\pi}{8} \left( \frac{K_I}{\sigma_Y} \right)^2$$

$$\text{Rice } J = \int_{\Gamma} \left( w dy - \bar{T} \frac{\partial \bar{u}}{\partial x} ds \right)$$

Huchinson-Rice-Rosengren, HRR

$$\sigma_{ij} = \sigma_Y \left( \frac{J}{\alpha \sigma_Y \varepsilon_Y I_n r} \right)^{1/(n+1)} \tilde{\sigma}_{ij}(\theta, n)$$

$$\varepsilon_{ij} = \alpha \varepsilon_Y \left( \frac{J}{\alpha \sigma_Y \varepsilon_Y I_n r} \right)^{n/(n+1)} \tilde{\varepsilon}_{ij}(\theta, n)$$

$$u_i = \alpha \varepsilon_Y \left( \frac{J}{\alpha \sigma_Y \varepsilon_Y I_n} \right)^{n/(n+1)} r^{1/(1+n)} \tilde{u}_i(\theta, n)$$

## Materialparametrar SAE1045

	<i>Monoton last</i>		<i>Cyklisk last</i>
$\sigma_y$	634MPa	$\sigma'_y$	414MPa
$n$	0.13	$n'$	0.18
$A$	1145MPa	$A'$	1344MPa
$\sigma_f$	1227MPa	$\sigma'_f$	1227MPa
$\varepsilon_f$	1.04	$\varepsilon'_f$	0.6029
		$b$	-0.095
		$c$	-0.66

$$E = 200GPa$$

$$\sigma_{TS} = 724MPa$$

$$\nu = 0.3$$