

Allgemeines: $\sigma = \frac{F}{A}$ [N/mm²] $\epsilon = \frac{\Delta l}{l_0}$ (mal hundert wenn ϵ groß, dann [MPa]) $E = \frac{\sigma}{\epsilon}$ (Hookesches Gesetz)

Festigkeitsbedingung: höhere Belastung, Werkstoffkennwert

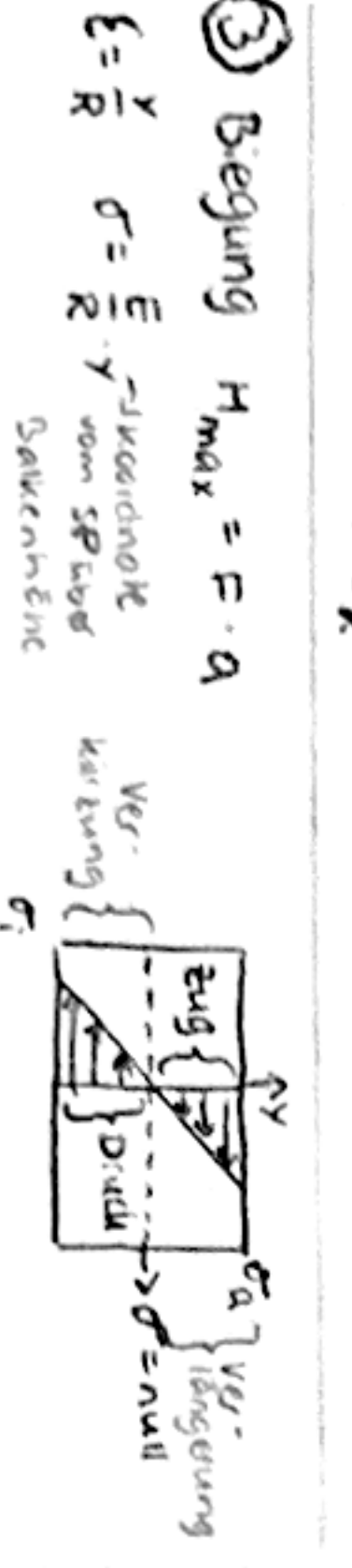
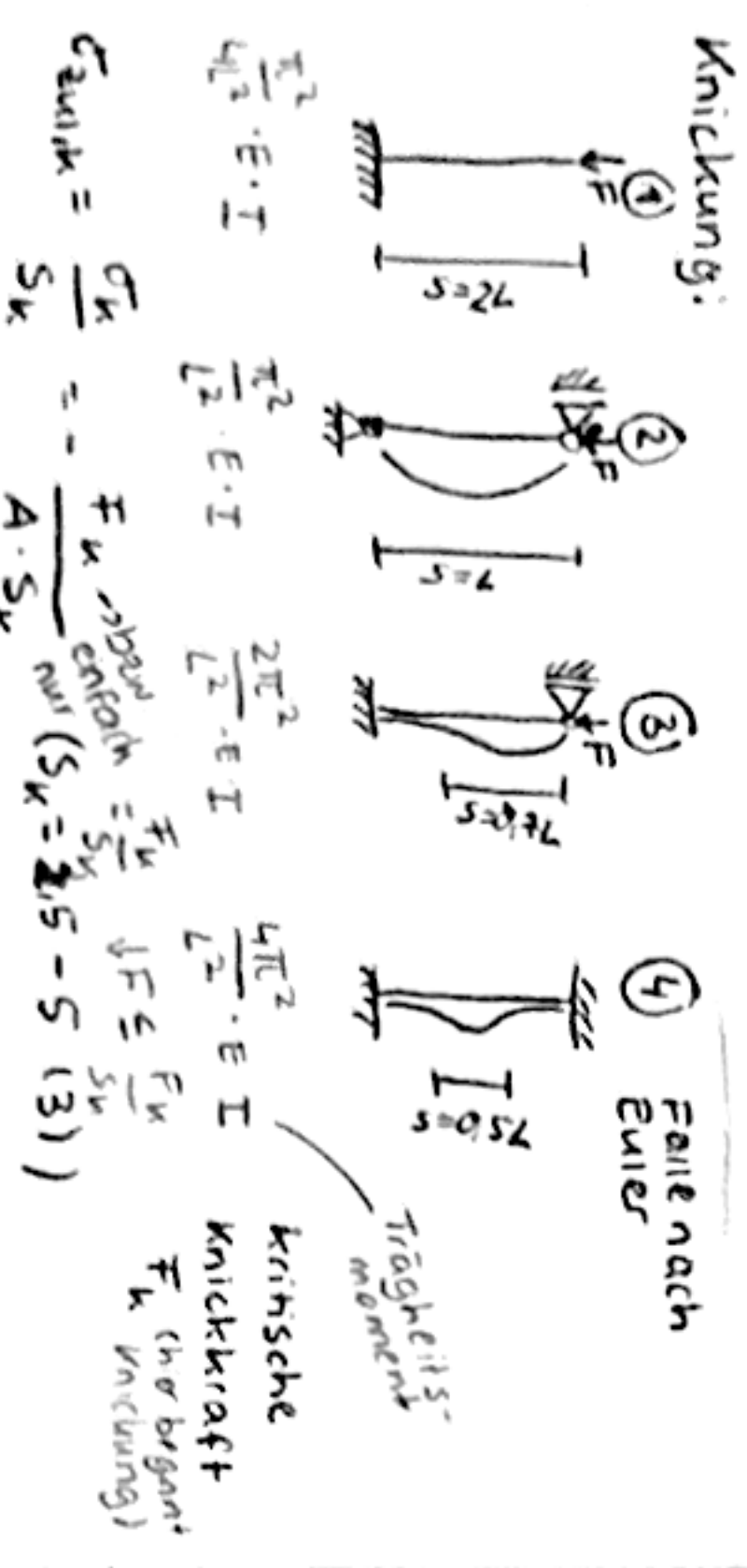
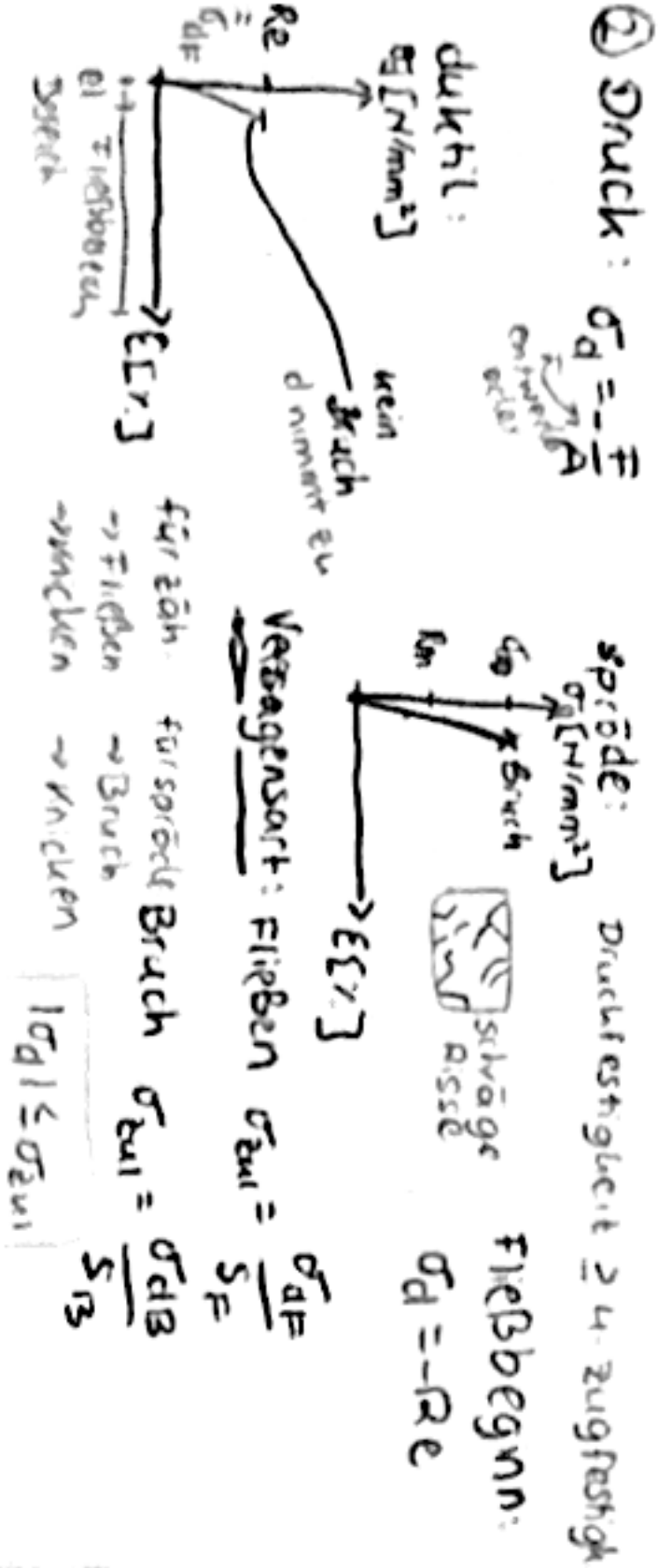
$\sigma_{zul} = \frac{\sigma_R}{S}$ (Abmessung) $\sigma_{zul} = \frac{\sigma_R}{S}$ (Sicherheit ≥ 1)

Grundbelastungsfälle



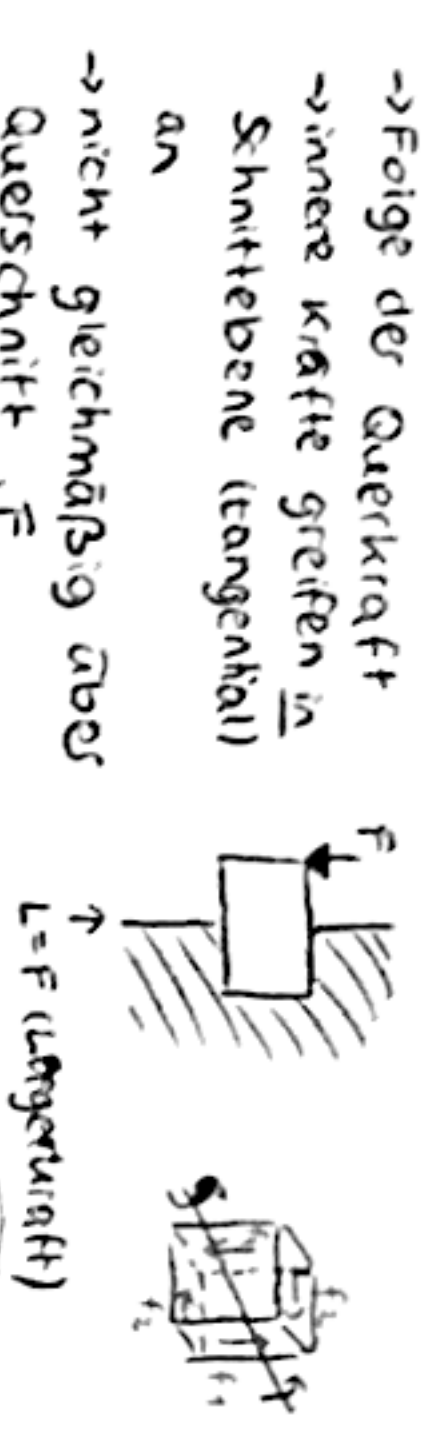
Sicherheit Fließen & Bruch:

Fließen	Bruch	Re	RE	SF	SF	SF	SF
Fließen	Bruch	Re	RE	SF	SF	SF	SF
Fließen	Bruch	Re	RE	SF	SF	SF	SF
Fließen	Bruch	Re	RE	SF	SF	SF	SF

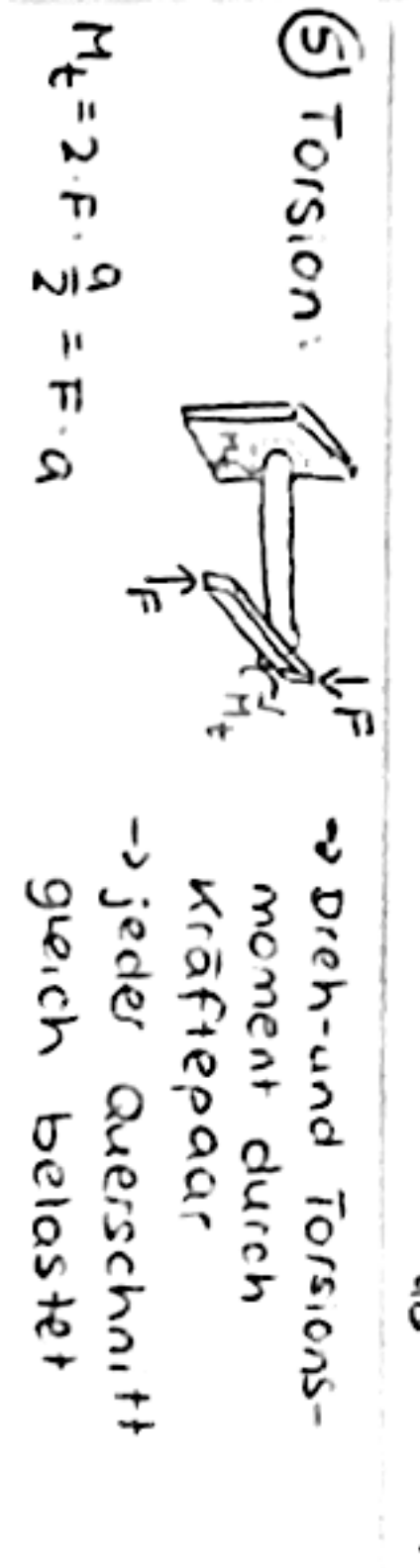


Biegung: $M_{max} = F \cdot a$
 $\sigma = \frac{M \cdot y}{I}$
 $\epsilon = \frac{\sigma}{E}$
 $\sigma_{max} = \frac{M_{max}}{W_0}$
 $\sigma_{min} = \frac{M_{min}}{W_0}$

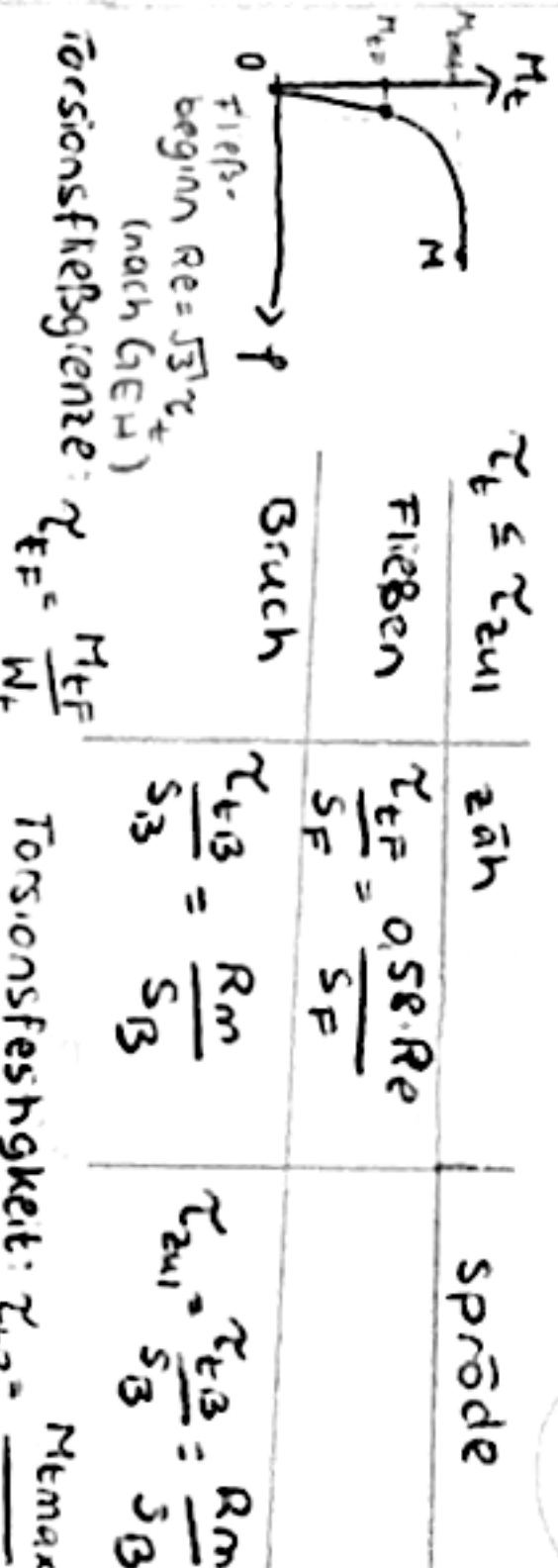
(4) Schub / Scherung (s-Bearbeitung)



$\tau = \frac{F}{A}$
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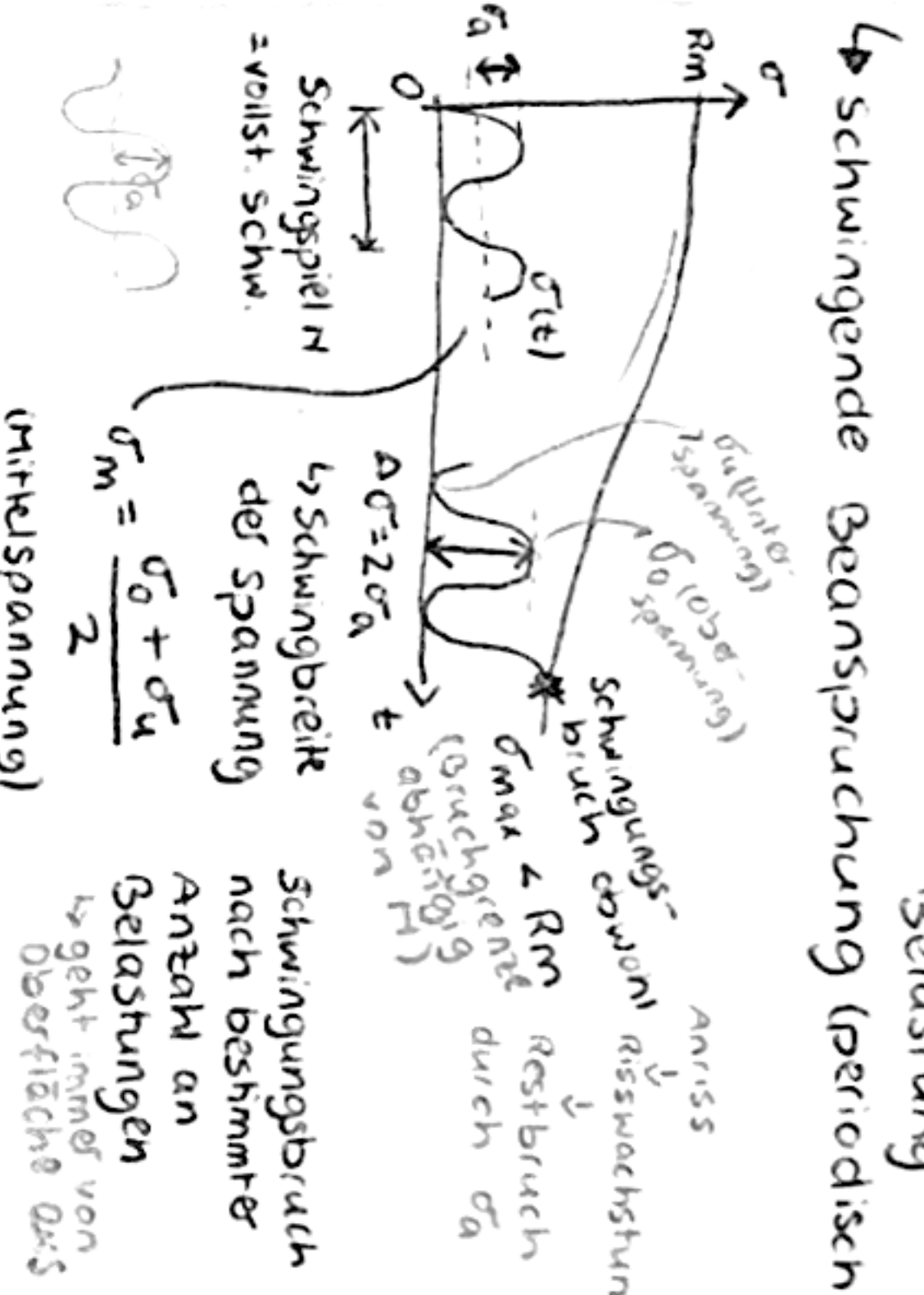
(5) Torsion:
 $M_t = 2 \cdot F \cdot \frac{a}{2} = F \cdot a$
 $\tau = \frac{M_t \cdot r}{I_p}$
 $\tau = \frac{M_t \cdot r}{I_p}$



Einheiten umrechnen:

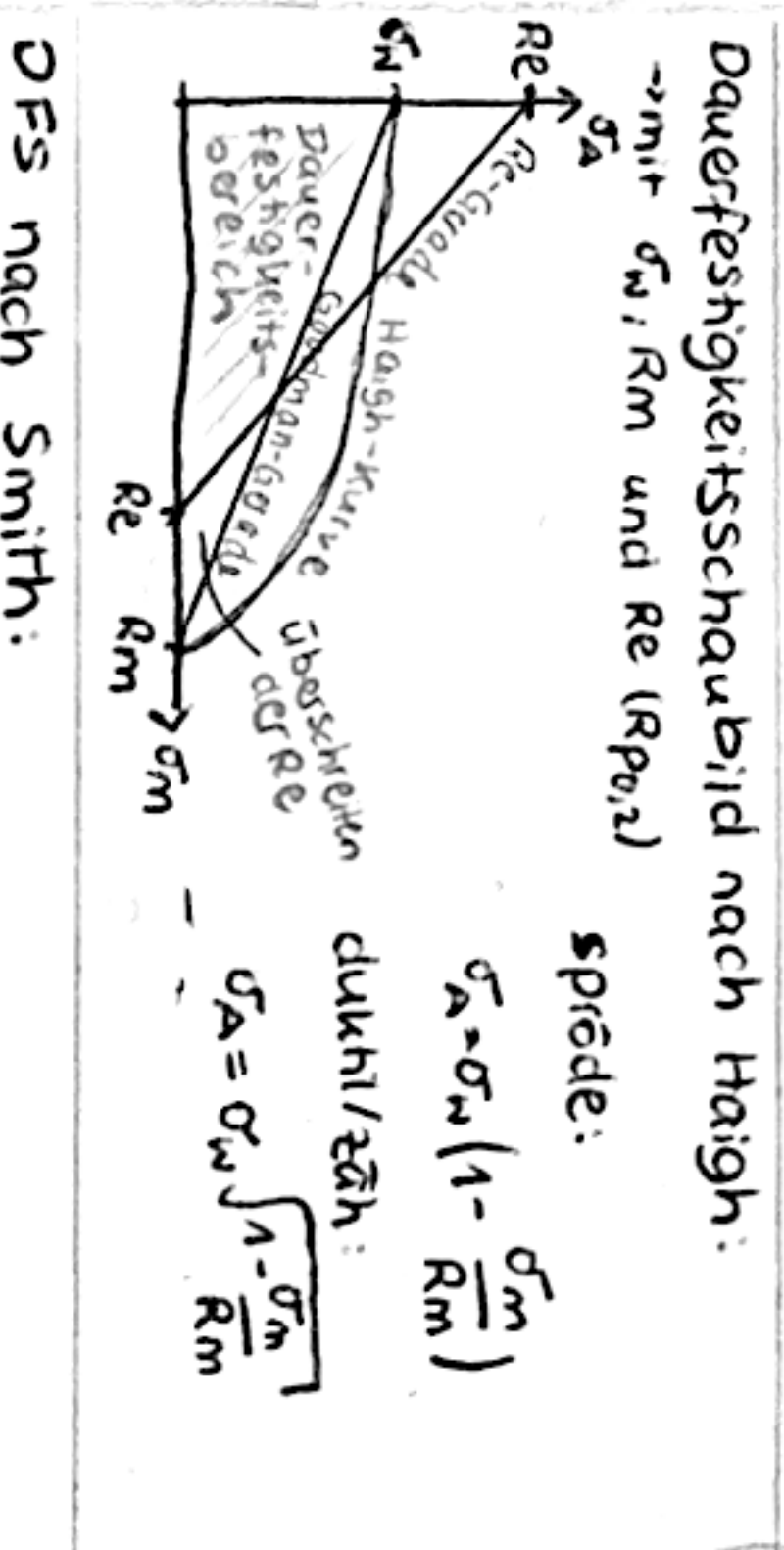
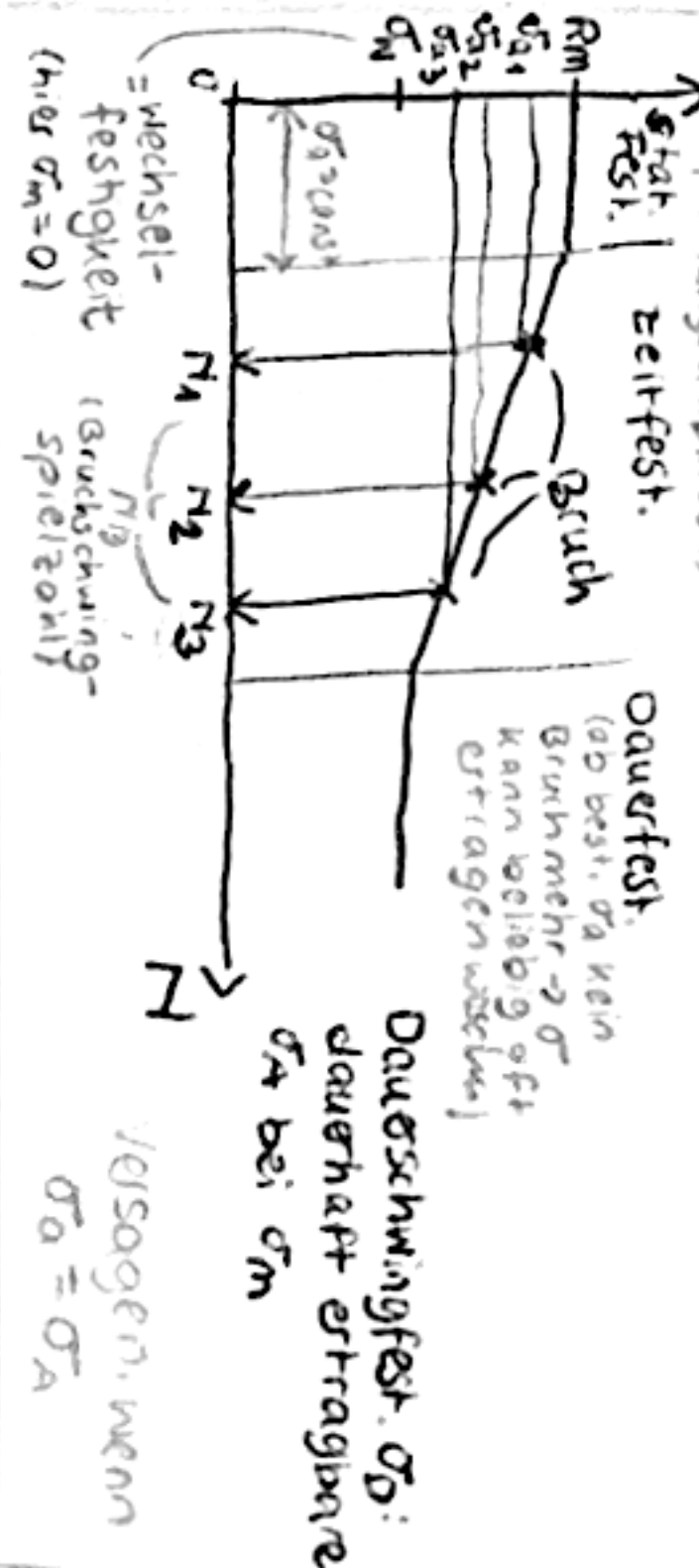
Einheit	umrechnen	Einheit	umrechnen
kilo	10 ³	deci	10 ⁻¹
mega	10 ⁶	centi	10 ⁻²
giga	10 ⁹	milli	10 ⁻³
		micro	10 ⁻⁶
		nano	10 ⁻⁹

Dynamische Beanspruchung - Zeitabhängige Belastung



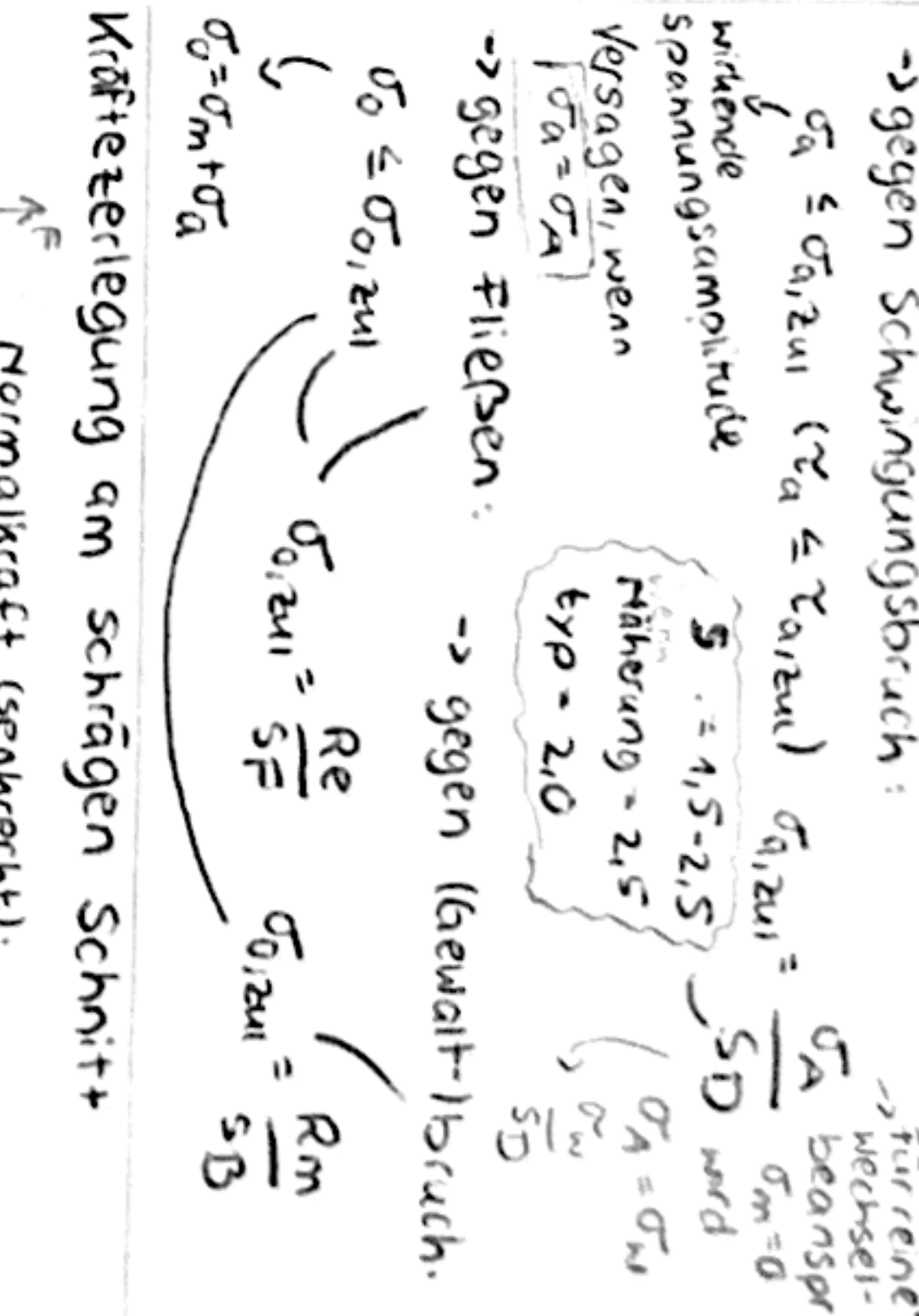
Einleitung der Beanspruchungsfälle:
 $\sigma_a = \frac{\sigma_R}{S}$
 $\sigma_a = \frac{\sigma_R}{S}$
 $\sigma_a = \frac{\sigma_R}{S}$

Dauerschwingversuch: Wöhler-Kurve
 $\sigma_a = \frac{\sigma_R}{S}$
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 $\sigma_a = \frac{\sigma_R}{S}$

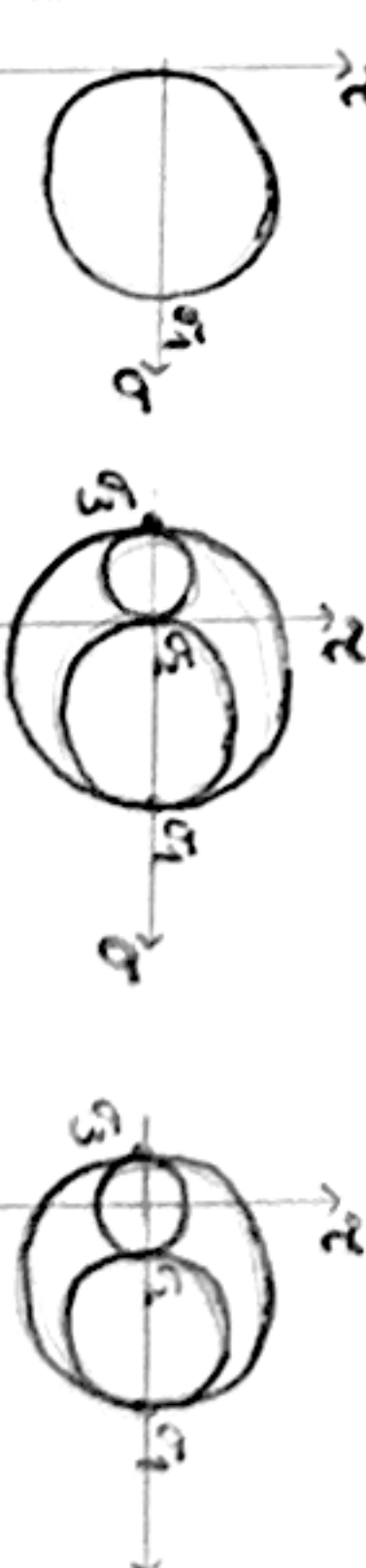
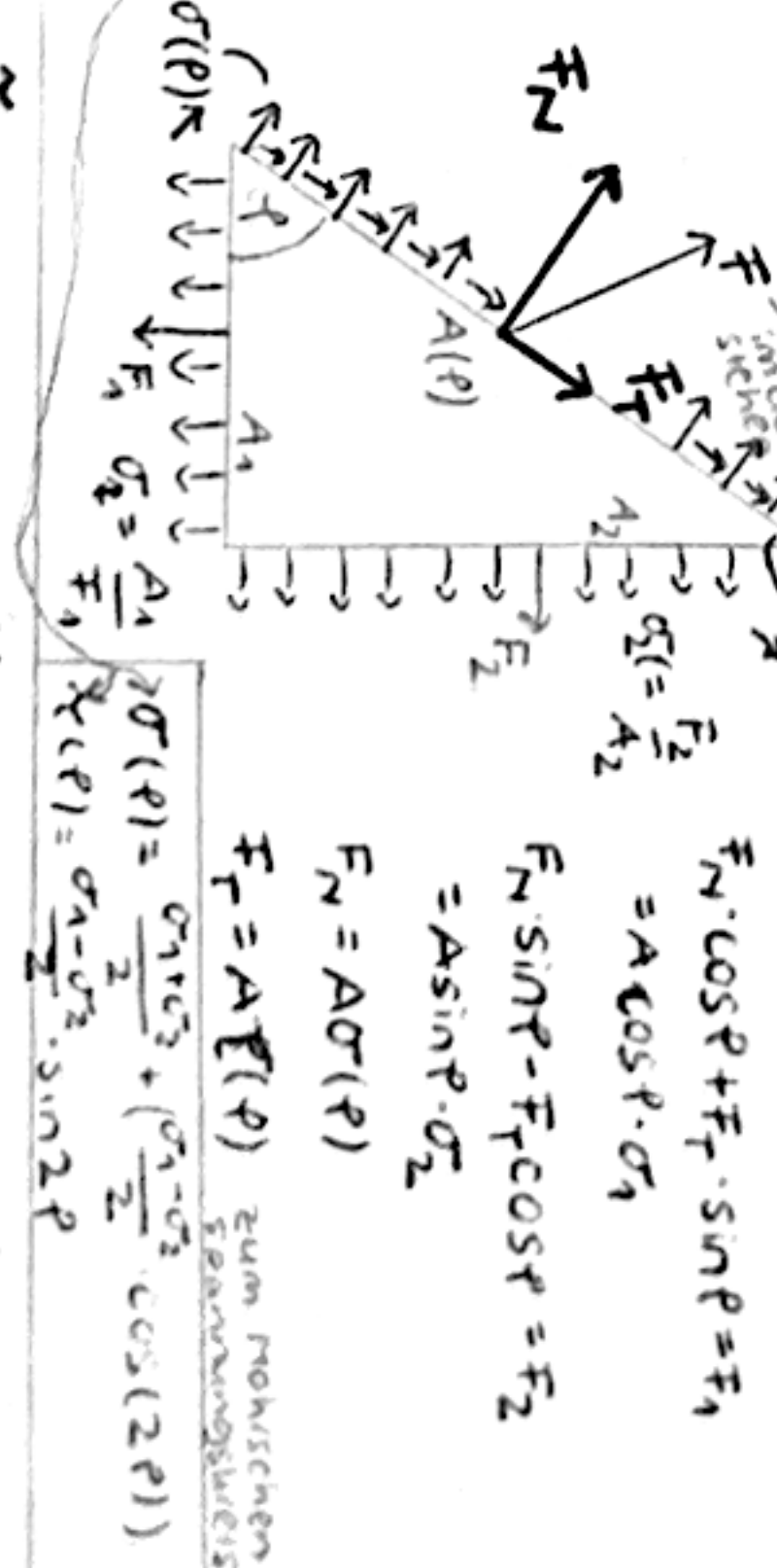
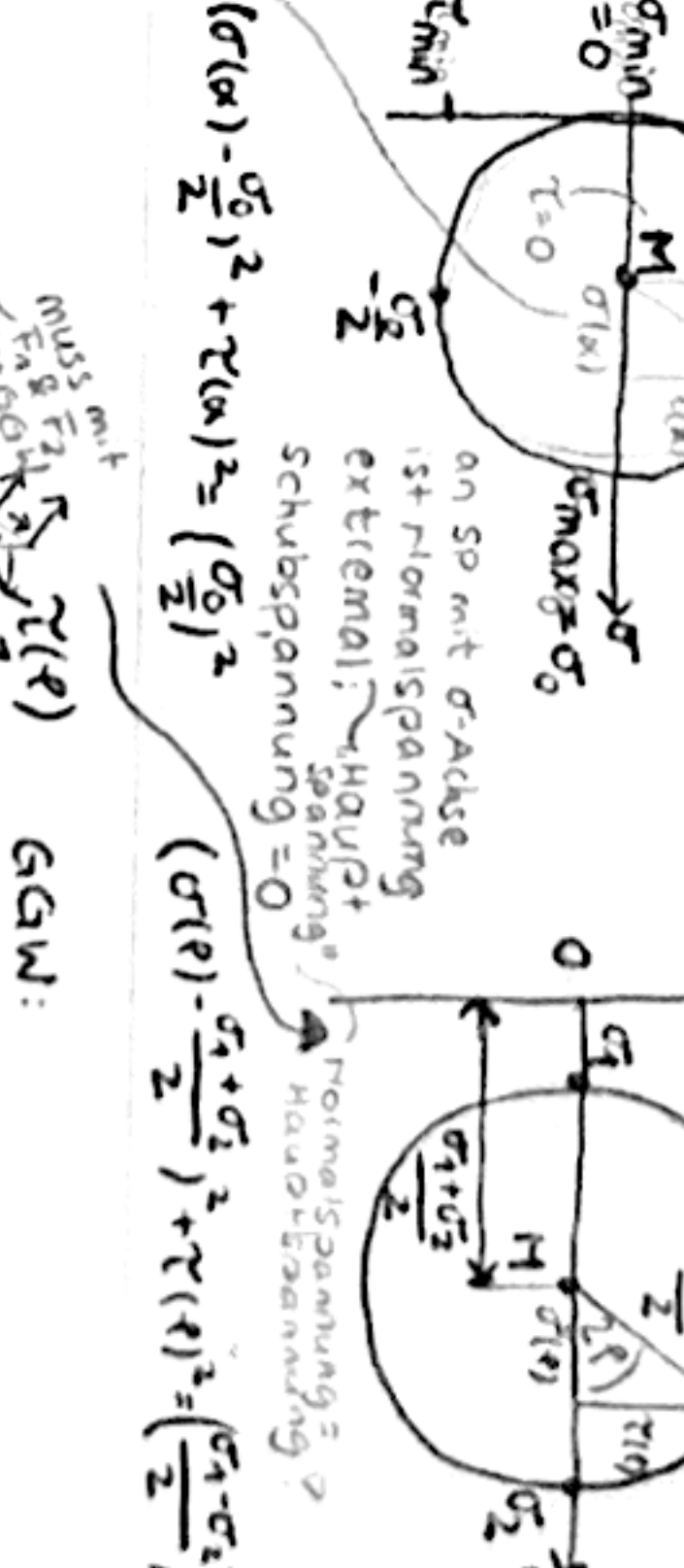
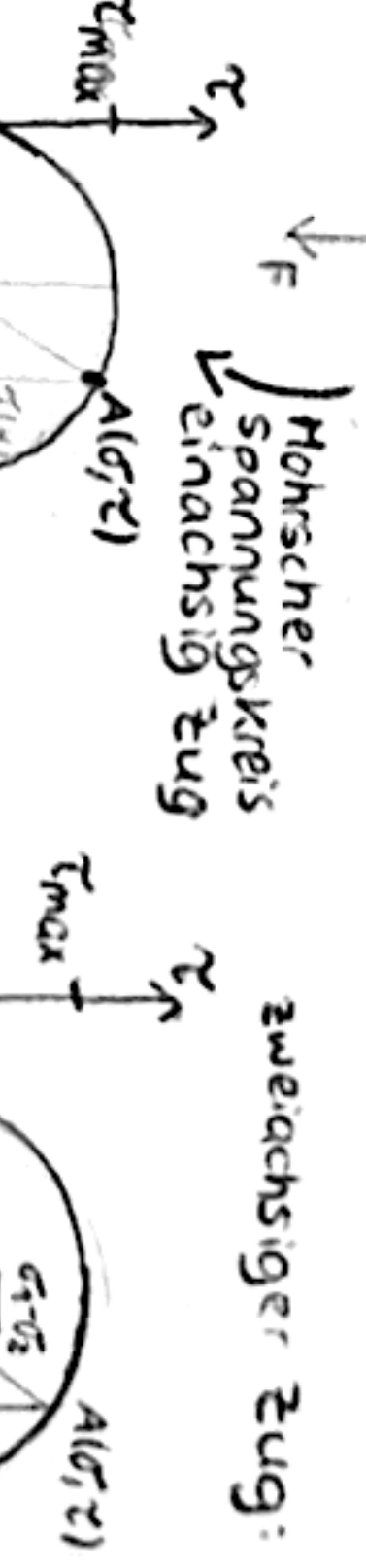


DFS nach Smith:
 $\sigma_a = \frac{\sigma_R}{S}$
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 $\sigma_a = \frac{\sigma_R}{S}$

Luftige Spannung bei Schwingungsbeanspruchung



Kräftezerlegung am schrägen Schnitt:
 $F_N = F \cdot \cos \alpha$
 $F_T = F \cdot \sin \alpha$
 $F_N = F \cdot \cos \alpha$



einachsig zweiachsig dreiachsig
 $\sigma_1, \sigma_2, \sigma_3$
 $\sigma_1, \sigma_2, \sigma_3$
 $\sigma_1, \sigma_2, \sigma_3$

