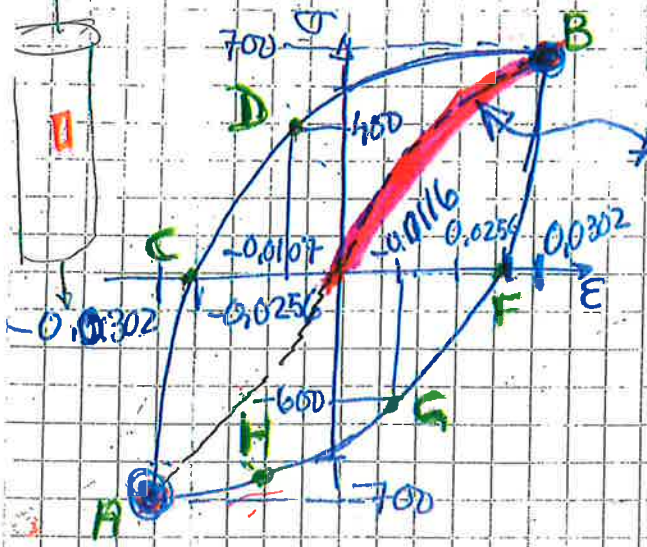
8.04/

HYSTERESISLOOP: Rita loopen för $\sigma = 1700$ MPa



$\sigma_a = 700$ MPa ; STABILISERAD KURVA:

$\varepsilon_a = \varepsilon_{ae} + \varepsilon_{ap} = \frac{\sigma_a}{E} + \left(\frac{\sigma_a}{H'}\right)^{1/n'} = \left(\text{ANVÄNDS CYKLISKA DATA}\right)$

$= \frac{\sigma_a}{200\,000} + \left(\frac{\sigma_a}{1344}\right)^{1/0.18}$

EXTREMVÄRDEN:

$\pm\varepsilon_a = \pm(\varepsilon_{ae} + \varepsilon_{ap}) = \pm\varepsilon_a = \left(\text{CYKLISKA DATA}\right)$

$= \pm\left(\frac{700}{200\,000} + \left(\frac{700}{1344}\right)^{\frac{1}{0.18}}\right) = \pm 0.0302$

$\Rightarrow$ Ändpunkter $(\sigma;\varepsilon)$: (700, 0.0302) och B

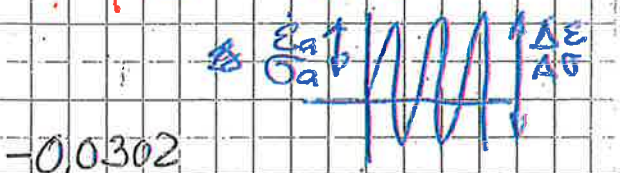
(σ,ε): (-700, -0.0302) A

Hysteresloop A → B

$\left(\frac{\Delta\varepsilon}{2} = \frac{\Delta\sigma}{2E} + \left(\frac{\Delta\sigma/2}{H'}\right)^{1/n'}\right)$

9.3.a] Bestäm några punkter på $\Delta\varepsilon = \frac{\Delta\sigma}{E} + 2\left(\frac{\Delta\sigma}{2H'}\right)^{1/n'}$

$\Delta\varepsilon = \frac{\Delta\sigma}{200\,000} + 2\left(\frac{\Delta\sigma}{2\cdot 1344}\right)^{\frac{1}{0.18}}$



A START: $\sigma = -700$, $\varepsilon = -0.0302$

NY PUNKT $\begin{cases} \sigma = \sigma^{start} + \Delta\sigma = (-700 + \Delta\sigma)\text{ MPa} \\ \varepsilon = \varepsilon^{start} + \Delta\varepsilon = (-0.0302 + \Delta\varepsilon) \end{cases}$

$\Delta\sigma = 700$ MPa → $\sigma = 0$

$\varepsilon = -0.0302 + \Delta\varepsilon = -0.0302 + \frac{700}{200\,000} + 2\left(\frac{700}{2\cdot 1344}\right)^{1/0.18} = -0.0256$

0.0046 C

$\Delta\sigma = 1100$ MPa → $\sigma = -700 + 1100 = 400$ MPa

$\varepsilon = -0.0302 + \Delta\varepsilon = -0.032 + \frac{1100}{200\,000} + 2\left(\frac{1100}{2\cdot 1344}\right)^{1/0.18} = -0.0107$

0.0195 D

$\Delta\sigma = 1400$ MPa → B $\sigma = -700 + 1400 = 700$ MPa

$\varepsilon = -0.0302 + \frac{1400}{200\,000} + 2\left(\frac{1400}{2\cdot 1344}\right)^{\frac{1}{0.18}} = 0.0302$ ✓

Hysteresisloop B → A

(B) STARTPUNKT B: $(\sigma, \varepsilon) = (700, 0.0302)$

$\Delta\sigma = 700 - \Delta\sigma$
$\varepsilon = 0.0302 - \Delta\varepsilon$
} NY PUNKT

$\Delta\sigma = 700\,MPa \rightarrow \sigma = 700 - 700 = 0$

$\varepsilon = 0.0302 - \Delta\varepsilon = 0.0302 - \left(\frac{700}{200\,000} + 2\left(\frac{700}{2\,134}\right)^{\frac{1}{0.18}}\right)$

0.0046

$= 0.0256$ F

$\Delta\sigma = 1100\,MPa \rightarrow \sigma = 700 - 1100 = -400\,MPa$ G

$\varepsilon = 0.0302 - \Delta\varepsilon = 0.0302 - 0.0195 = 0.0107$

$\Delta\sigma = 1300\,MPa \rightarrow \sigma = 700 - 1300 = -600\,MPa$

$\varepsilon = 0.0302 - 0.0418 = -0.0116$ H

$\Delta\sigma = 1400\,MPa \rightarrow$ A

= HÅRDNANDE - MJUKNANDE SID * FÖRST

Hårdnar eller mjuknar materialet?
(work-hardening / work-softening)

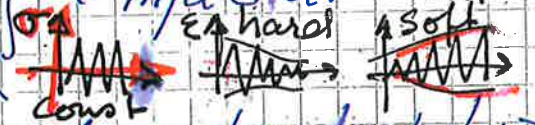
Monotont: $\varepsilon = \varepsilon_e + \varepsilon_p = \frac{\sigma}{E} + \left(\frac{\sigma}{A}\right)^{1/n}$ $A = 1145\,MPa$ $n = 0.13$

Cykliskt: $\varepsilon_a = \varepsilon_{ae} + \varepsilon_{ap} = \frac{\sigma_a}{E} + \left(\frac{\sigma_a}{A'}\right)^{1/n'}$ $A' = 1344\,MPa$ $n' = 0.18$

$\sigma = 700\,MPa \rightarrow \varepsilon = 0.0262$

$\sigma_a = 700\,MPa \rightarrow \varepsilon = 0.0302$

} ε ökar dvs ⇒ mjuknar SID *



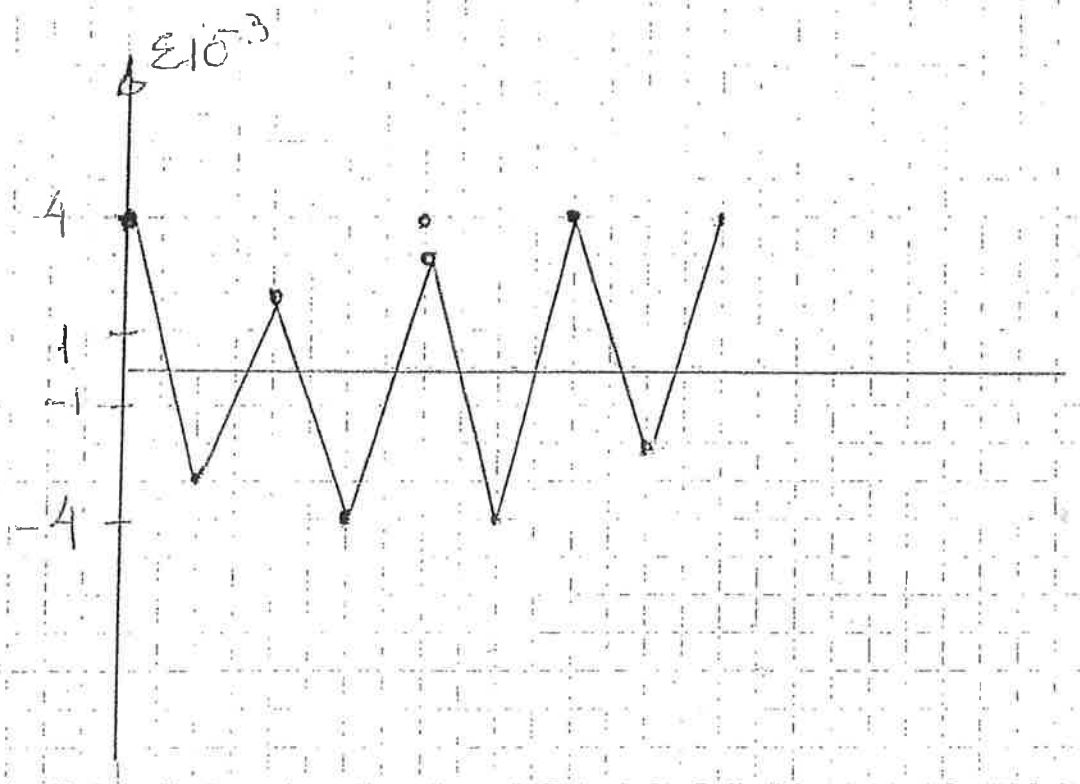
(Alt: för att erhålla $\varepsilon = 0.302$ med monoton last krävs last runt 715 MPa)

Arean III svarar mot arbetet/värmen som "förloras" vid cyklisk last. Kallas MATERIAL DÄMPNING

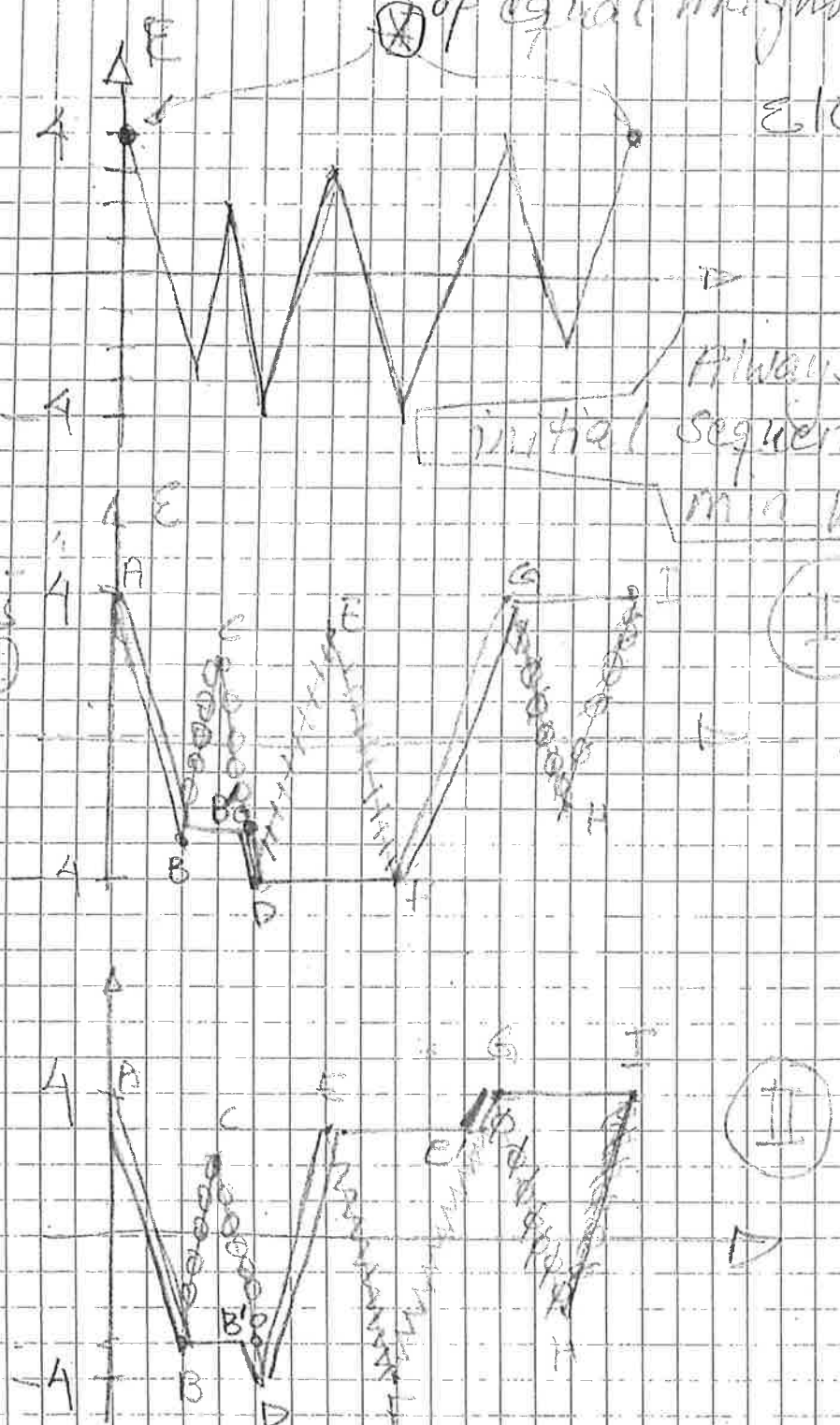
Allm: Mjuknande material om $\sigma_y > 0.85\,\sigma_{TS}$ σ_{TS} *

Hårdnande $\sigma_y < 0.7\,\sigma_{TS}$

$\varepsilon 10 = 4, -3, 2, -4, 3, -3, 4, -2, 1$ R1



RAIN FLOW COUNT



⊗ of equal magnitude = max R

$\varepsilon_{10}^{3} = 4, -3, 2, -1, 3, -4, 4, -2, 4$

Always complete an initial sequence with max or min values, like points ⊗

TWO ALTERNATIVES (I) AND (II)

	ε_{min}	ε_{max}	ε_a	$\Delta\varepsilon$	
ABB'DFGI	4	4	4	8	(I)
BCB'	3	3	3	6	
DEF	2	2	2	4	
GHI	3	3	3	6	
ABB'DE'GI	4	4	4	8	(II)
BCB'	3	3	3	6	
E'F	2	2	2	4	
GHI	3	3	3	6	

The smaller

$\varepsilon 10^{-3} = 5, -1, 3, 2, 4, -2, 3, -9, 1,$

$-5, -1, -3, 5$

R2