

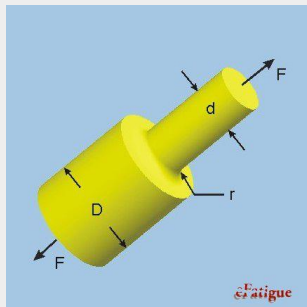
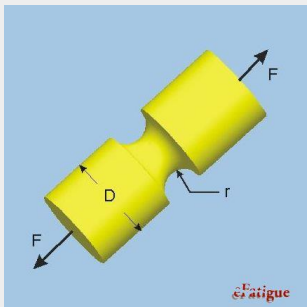
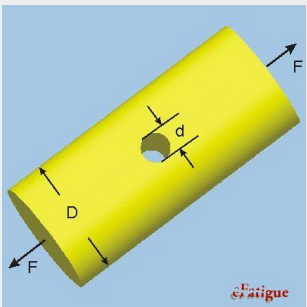
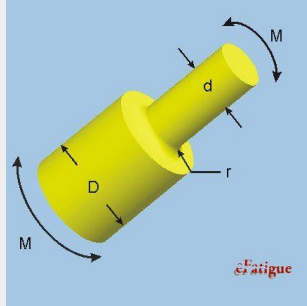
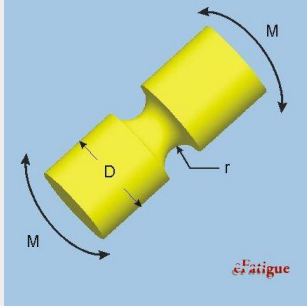
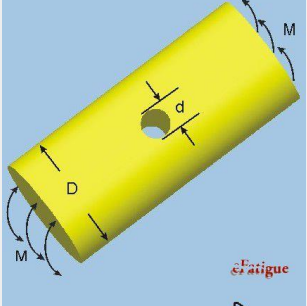
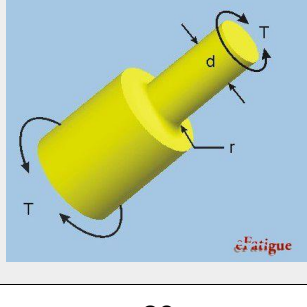
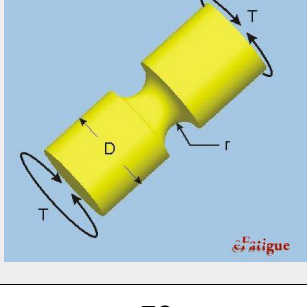
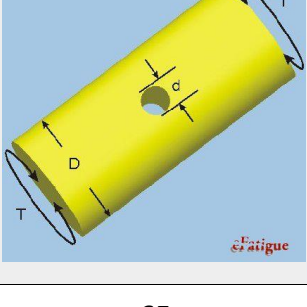
## Fatigue and fracture Homework

The depicted part is subjected to a cyclic loading. The ultimate aim of the homework is to predict the expected lifetime of the part by the strain-life method. The figures and the personal code determine the exact problem in geometry, loading and material order. Subtasks:

- (i) Find the critical cross-section and critical point of the part (maximum stress).
- (ii) Create the cyclic flow curve of the material.
- (iii) Plot the Neuber-hyperbola for the given geometry.
- (iv) Determine the maximum strain at the critical point.
- (V) Create and plot the unified S-N curve for the given material.
- (vi) Predict the expected lifetime of the part, define the characteristic of the failure mode.

The detailed, explained and commented documentation with descriptions, equations and plots, prepared by engineering fastidiousness should be sent via e-mail to [orbulov@eik.bme.hu](mailto:orbulov@eik.bme.hu) under the filename of <Given name\_First name\_Neptun code.pdf>.

**Deadline: 6<sup>th</sup> December 2024. 12:00.**

Geometry		Shaft with a fillet	Grooved shaft	Shaft with hole
Code		1	2	3
Sketch	Tension			
	Bending			
	Torsion			
D (mm)	80	70	65	
d (mm)	50	-	10	
R (mm)	5	5	-	

Loading	Bending	Torsion	Axial
Code	1	2	3
$M_h$ (Nm)	4750	-	-
$M_t$ (Nm)	-	9570	-
$F_a$ (kN)	-	-	500

Material	C45	30CrNiMo8	17Mn4
Kód	1	2	3
r	-1	-1	-1
E (GPa)	207	200	216
$R_{p0,2}$ (MPa)	551	918	390
$R_m$ (MPa)	774	1031	470
Z (%)	68	68	55
$K'$ (MPa)	1235	1042	1071
$n'$ (MPa)	0,158	0,067	0,218
$\sigma'_f$ (MPa)	1012	1101	925
b (-)	-0,08	-0,056	-0,134
$\epsilon'_f$ (-)	0,285	1,915	0,555
c (-)	-0,51	-0,818	-0,625