Strain-Life Fatigue (Coffin–Manson–Basquin)

Fatigue life for a strain amplitude from the combined elastic (Basquin) and plastic (Coffin–Manson) strain-life equation, with the transition life.

Method: Coffin–Manson–Basquin strain-life equation

Input parameters

Unit system: SI

Parameter	Value	Unit
Fatigue strength coefficient	1,000.0	MPa
Fatigue strength exponent	-0.090000	
Fatigue ductility coefficient	0.50000	
Fatigue ductility exponent	-0.60000	
Elastic modulus	200.00	GPa
Total strain amplitude	0.004000	

Calculated results

Parameter	Value	Unit
Cycles to failure	5,687.0	
Elastic strain amplitude at that life	0.002157	
Plastic strain amplitude at that life	0.001843	
Transition life (elastic = plastic)	4,173.9	

Notes for this case

• ε_a = (σ'_f/E)(2N)^{b} + ε'_f(2N)^{c} for fully reversed loading. Below the transition life plastic strain dominates (low-cycle fatigue); above it, elastic strain. Mean stresses need a correction (e.g. Morrow); take the four constants from strain-controlled tests.

Formula and method

The formula is shown on the calculator page: https://calc.firecad.com/materials/properties/coffin-manson-strain-life

Variables

\sigma'_f	Fatigue strength coefficient	Pa
b	Fatigue strength exponent	-
\varepsilon'_f	Fatigue ductility coefficient	-
c	Fatigue ductility exponent	-
E	Elastic modulus	Pa
ε_a	Total strain amplitude	-
N_f	Cycles to failure	-
$\varepsilon_{a,e}$	Elastic strain amplitude at that life	-
$\varepsilon_{a,p}$	Plastic strain amplitude at that life	-
N_t	Transition life (elastic = plastic)	-

Method and standards

Strain-life.

Assumptions and limits

- Fully reversed, constant amplitude strain.

References

Coffin–Manson–Basquin strain-life equation

Report details

Report reference	FCC-PE9G-7AFB (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/materials/properties/coffin-manson-strain-life

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.