

Fatigue

Mechanical Engineering

Cyclic loading, S-N curves and why finish and notches matter so much.

Cyclic loading cracks a part far below yield, after a number of cycles set by the stress amplitude.

STEEL ENDURANCE LIMIT

roughly half the tensile strength

HIGH-CYCLE REGIME

above 10^4 cycles

MINER FAILURE

sum of $n \div N$ reaches 1

- Steel S-N curves flatten near a million cycles
- Aluminium has no true endurance limit
- Surface finish and size cut the limit hard
- Notches and holes start almost every crack
- Tensile mean stress shortens life sharply
- Miner's rule sums $n \div N$ over the load blocks

LOOK FOR IT

A shaft at 1500 rpm sees a million cycles in about eleven hours.

Fatigue data scatters by a large factor. Educational reference; design to a fatigue code and test.