

**Problem** A shaft must transmit a torque of 1000 Nm, with superimposed torsional vibrations causing an alternating torque of 250 Nm. A safety factor of 2 should be applied to both loads.

A heat treated alloy steel is to be used, with  $S_u = 1.2\text{GPa}$  and  $S_y = 1.0\text{GPa}$ . The shaft will have a shoulder, with  $D/d=1.2$  and  $r/d=0.05$  as show in the diagram. A good quality commercial ground finish is to be specified, what diameter is required for infinite life?

