Tutorial 1

January 16, 2017

ME-30602, 2016-17 Spring Semester

Problem 1: A cylindrical part of diameter d is loaded by axial force P causing stress of $\sigma = 4P / \pi d^2$. Load is known with an uncertainty of ± 10%, the diameter is known with an uncertainty (tolerance) of ± 5% and the strength (stress causing failure) is known with an uncertainty of ± 15%. Determine the minimum design facture to prevent the failure of the part.

Problem 2: A solid circular rod of diameter d is subject to a bending moment M = 100 N-m. The resulting stress induced is $\sigma = 32M / \pi d^3$. Using a material strength of 175 MPa and a design factor of 3, determine the minimum diameter of the rod. Using Table A–17 (of Shigely's book) select a preferred diameter and determine the resulting factor of safety.

Problem 3: Select suitable material along with brief justification for the following parts or objects. State the material properties of the selected materials. Also state the possible failure mechanism of the parts.

(a) Metal cutting saws
(b) Rolling contact bearings in your bicycle
(c) Lathe bed
(d) Crankshaft of an IC engine
(e) Pushrod for valve gear train of an IC engine
(f) Cam for valve gear train of an IC engine
(g) Spring for valve gear train of an IC engine
(h) Rim of locomotive wheels
(i) Door hinge