Tutorial 2

January 23, 2017

ME-30602, 2016-17 Spring Semester

Problem 1: 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

Problem 2: A cantilever beam is loaded by a transverse force at its tip. The following materials are being considered: tungsten carbide, high-carbon heat-treated steel, polycarbonate polymer and aluminum alloy. Using the Ashby charts, recommend the best material for the cantilever. The most probable failure modes is by exceeding static strength and it is desired to minimize the weight.

Problem 3: An application requires the support of an axial load of 400kN with a rod of circular cross section. The dimensions and material should be such that the stress in the rod should not exceed the yield strength of the material. Select the material from the list given below for each of the following additional design goals from the list of materials:

(a) Minimize diameter
(b) Minimize axial deflection
(c) Minimize cost

Look for the material properties from tables A-5, A-20, A-21, A-24 of Shigley's book (9^{th}/10^{th} edition). The list of materials along with their cost per kg of the rod is given below.

Material	**Cost/kg (Rs.)**
1020 HR steel	40
1020CD steel	48
1040 Q&T at 800F	55
4140 Q&T at 800F	125
Wrought Al 2024 T3	165
Titanium Alloy (Ti-6Al-4V)	1100