

WORCESTER POLYTECHNIC INSTITUTE MECHANICAL ENGINEERING DEPARTMENT

DESIGN OF MACHINE ELEMENTS ME-3320, A'2021

Extra-credit problem #1

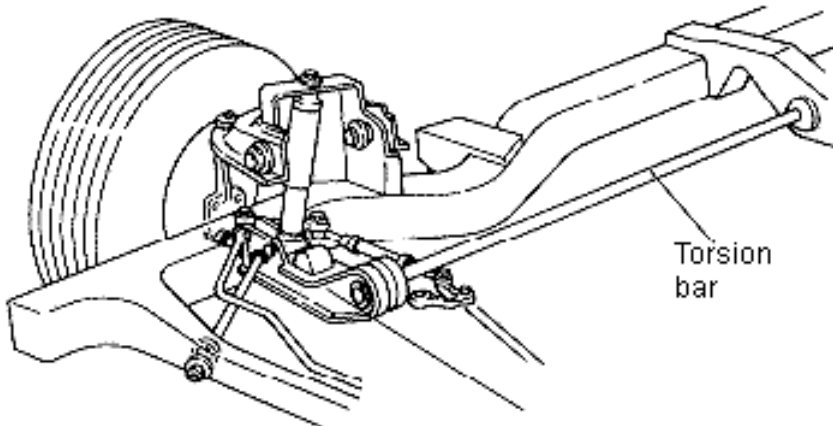
September 2021



Static failure theories:

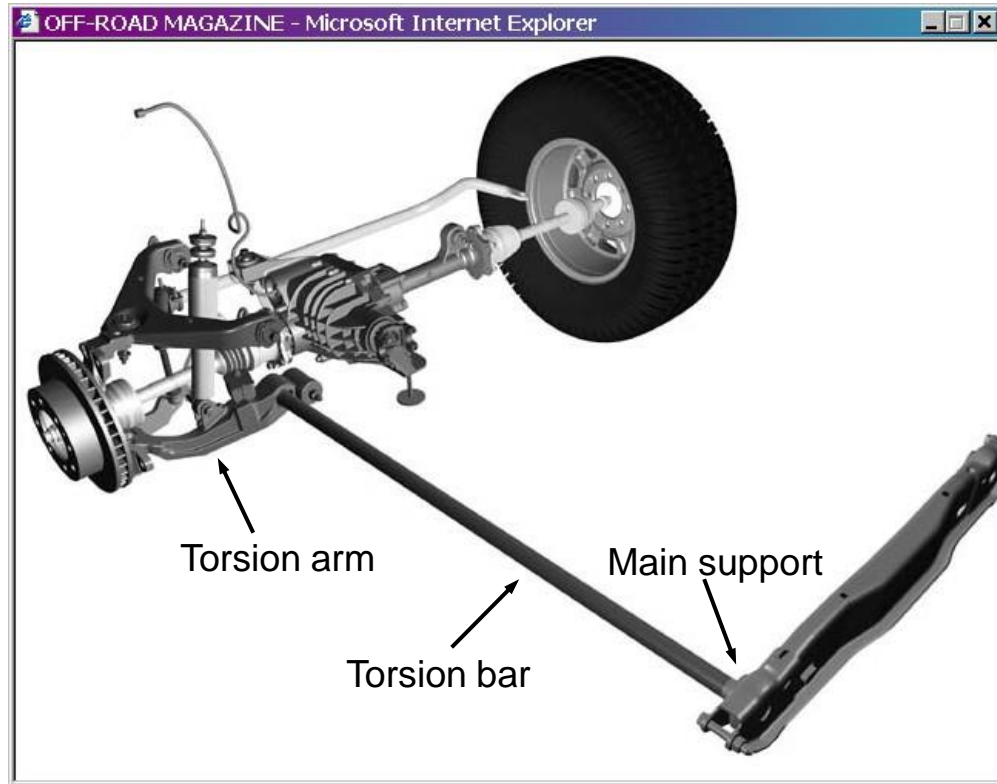
Torsion bar - optional extra credit problem

A longitudinal torsion bar mounted along the chassis



<http://www.monroe.com>

Typical suspension (used in the VW Beetle)

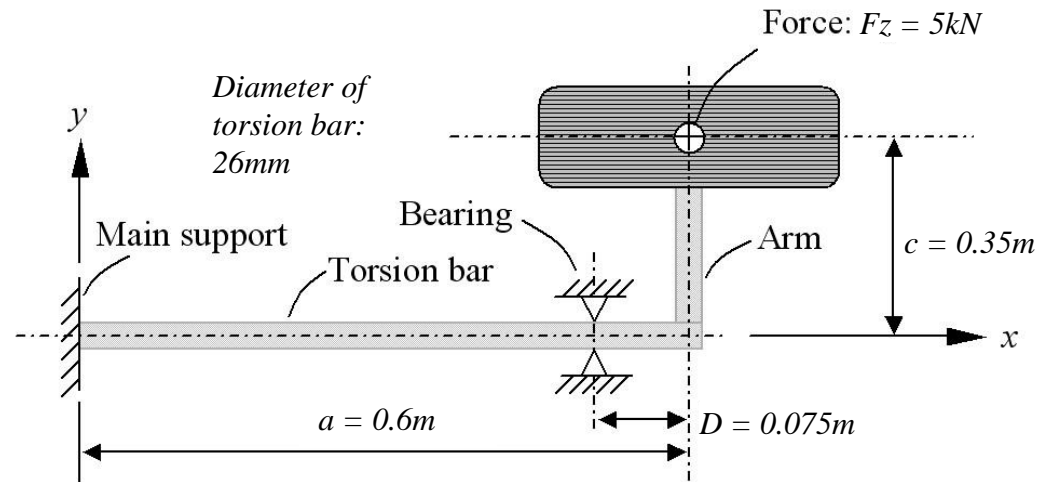


Static failure theories:

Optional - Torsion bar: extra credit problem (50 points in any exam)

In the rear wheel suspension of the Volkswagen Beetle, the spring motion is provided by a torsion bar fastened to an arm on which the wheel is mounted. See Figure below and previous page. According to the Figures, the torque in the torsion bar is created by the force F_z acting on the wheel from the ground through a lever arm.

- 1) Determine the safety factors for the torsion bar based on both the distortion energy theory (DET) and the maximum shear stress theory (MSST) and compare them. Assume the material to be steel SAE 4130 quenched and tempered at 1,200 °F;
- 2) Determine the safety factors for the torsion bar based on the modified-Mohr theory and plot the state-of-stresses together with the failure envelope. Assume the material to be Gray Cast-iron Class 60.



Due Monday,
Sep. 27th, 2021,
before 5:00 pm

Email solution to
instructor & Yash

- Only complete solutions are accepted
- Note that conditions indicate a statically indetermined situation

