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

Typical suspension (used in the VW Beetle)

http://www.monroe.com
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

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

Email solution to instructor & Yash