

# MECHENG513/AUTO 513 Fundamentals of Auto Body Structures

**Instructor** Donald E. Malen

## **Course Objective:**

*Automobile design is experiencing a period of dynamic change. Alternative powertrains, fuels, materials, safety needs, and consumer demands for increased refinement will have a profound effect upon body architecture. The emphasis for this course will be on gaining insight into auto body structural behavior and the relationship to the vehicle. Body structure element behavior will be examined including thin walled members, panels, joints, spot welds, and local attachments. Structural models for the primary requirements will be analyzed in detail. These include global body bending, body torsion, crashworthiness, and vibration behavior. The importance of bending and torsion stiffness on the perceived level of refinement will be discussed, and tools for analysis will be developed. The interaction between structural topology and vehicle packaging and styling will be treated, including the need for trade-off analysis in selecting the best structure configuration. Methods for selection of alternative body materials will be covered.*

## **Course Prerequisites:**

Undergraduate course in Strength of Materials or the equivalent, or permission from the instructor

## **Text Book:**

*Fundamentals of Automobile Body Structure Design*, D. Malen, SAE International, 2011.

## **Course Topics:**

- Strength of Materials Review
- Thin Wall Beam Section Design in Automobiles
- Auto Body Panels; Plates and Shells
- Auto Body Bending, principles of joint design
- Auto Body Torsion, weld structural performance
- Auto Body Crashworthiness, front barrier analysis and design, side impact analysis and design
- Vibration, source-path-receiver model, mode map development, modal analysis
- Vehicle Integration and Topology, vehicle styling and layout, mass analysis, structure topology
- Auto Body Material Selection
- Auto Body Platform Engineering, economics of body manufacture

**Homework:** Quantitative problems applied to real auto design situations

HW1 Strength of materials review

HW2 Thin walled beams

HW3 Plates and Shells

HW4 Body Bending

HW5 Body Torsion

HW6 Crashworthiness

HW7 Vehicle Integration: Mini design project. (Done as a team). Create a body structure concept to meet a given vehicle package and customer segment.

## **Mid-term Quiz, Final Exam**

Six homework assignments (6x50points)	300 points
Mid-term Exam	250 points
End-term Exam	250 points
Mini Design Project Report	<u>200 points</u>
Total	1000 points