

Code: ING-IND/06

Credits: 9

Matter: Vehicle Aerodynamics

Main language of instruction: Italian

Other language of instruction: English

Teaching Staff

Head instructor

Prof. Tiziano Pagliaroli – tiziano.pagliaroli@unicusano.it

Introduction

Understanding of the fundamentals of aerodynamics and vehicle body aerodynamic optimization.

Learning of the main measurement techniques applied in aerodynamics.

Objectives

At the start of course, prerequisite of the subject will be discussed. One/Two internal exams may be conducted.

Assignment based on course content will be given to the student for each unit/topic and will be evaluate.

Competencies:

- Understanding of the physical phenomena regulating by the Navier-Stokes equation. Knowledge of the main strategies for reducing aerodynamic drag. Knowledge of aerodynamic load increase strategies. Knowledge of intrusive and non-intrusive measurement techniques applied in wind tunnels. Knowledge of the concept of turbulence and its influence on aerodynamics forces.

Syllabus

1 Introduction and scope fo the course – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles –External & Internal flow problems – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

2 Aerodynamic Drag of Cabs Car as a bluff body – Flow field around car – Drag force – Types of drag force – analysis of aerodynamic drag – Drag coefficient of cars – Strategies for aerodynamic development – Low drag profiles.

3 Shape Optimization of Cabs Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – Effect of fasteners.

4 Vehicle Handling The origin of force and moments on a vehicle – Side wind problems – Methods to calculate forces and moments – Vehicle dynamics Under side winds – Effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles. 5 Wind Tunnels for Automotive Aerodynamics Introduction – Principles of wind tunnel technology – Limitation of simulation – Stress with scale models – Full scale wind tunnels – Measurement techniques – Equipment and transducers – Road testing methods – Numerical methods.

Evaluation system and criteria

The assessments of course is based on the following criteria:

- I) Final exam (95 %)
- II) Homework (5 %)

The final exam consists of 10-13 open question.

Bibliography and resources

- Lecture notes
- Recorded and live lectures

Recommended bibliography:

- Wolf-Heinrich Hucho, “Aerodynamics of Road Vehicles: From Fluid Mechanics to Vehicle Engineering”, Academic Press, 1998.