



COURSE DETAILS

CONTROL ORIENTED MODELS FOR VEHICLES DYNAMICS

SSD ING-IND/13

DEGREE PROGRAMME: AUTONOMOUS VEHICLE ENGINEERING (MOVE)

ACADEMIC YEAR 2022-2023

GENERAL INFORMATION – TEACHER REFERENCES

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GENERAL INFORMATION ABOUT THE COURSE

YEAR OF THE DEGREE PROGRAMME: I
SEMESTER: I
CFU: 6

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE “REGOLAMENTO”)

none

PREREQUISITES (IF APPLICABLE)

none

LEARNING GOALS

The course aims to provide the fundamental knowledges for the synthesis of physical-mathematical models of mechanical systems according to an approach that is functional to the design of the model-based controllers. The methodologies for modelling, the main sources of mechanical nonlinearities, as well as local linearization based tools are described, starting from the typical features of the mechanical systems, with particular reference to vehicle dynamics.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Students should learn the basic concepts of vehicle modelling with particular reference to control design.

Applying knowledge and understanding

Students should learn the concepts for the design of vehicle dynamics models oriented to the synthesis of control systems.

COURSE CONTENT/SYLLABUS

Systemic approach for the design of a mechanical system: mechatronic system; passive, semi-active and active controls; feedforward and feedback controls.

Modelling of mechanical systems: d’Alembert and Newton approaches, Lagrange approach, linear time-invariant mechanical systems, nonlinearities in mechanical systems, linearization technique.

State-space modelling, input-output modelling, transfer function, Laplace domain, Laplace transform, stability analysis. Control of mechanical systems in terms of vibrational characteristics. Longitudinal and lateral dynamics of road and railway vehicles. Control of the dynamics of road and railway vehicles.

READINGS/BIBLIOGRAPHY

Vehicle dynamics and control, R. Rajamani, Springer Ed.

Handbook of railway vehicle dynamics, S. Iwnicki, CRC Press

TEACHING METHODS

Lessons, numerical exercises with dedicated software.

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type	
written and oral	
only written	
only oral	X
project discussion	
other	

b) Evaluation pattern:

The final grade is formulated by the Examination Committee according to the scores achieved by the student in the discussion during the oral exam.

The final evaluation is discussed and highlighted to each student.