Preliminary design and sizing of mechatronic systems

Introduction

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Hello and welcome to this teaching module which concerns the preliminary design and sizing of mechatronic systems.

My name is Marc Budinger and I am a teacher at the mechanical engineering department of INSA, an engineering school in Toulouse.
You can contact me using the e-mail displayed here, if needed. I am now going to answer questions that you are probably going to ask yourself.

Organization and contents of the teaching module

Organization

Who ?
Marc Budinger
(DGM)

How to contact me ?
marc.budinger@insa-toulouse.fr

How many hours ?
30 hours = 6 lectures + 6 slots labs and tutorials + 15 slots for projects

Evaluation ?
1 written control
1 project

Contents

Why ?
Multidomain power transmission sizing and optimization

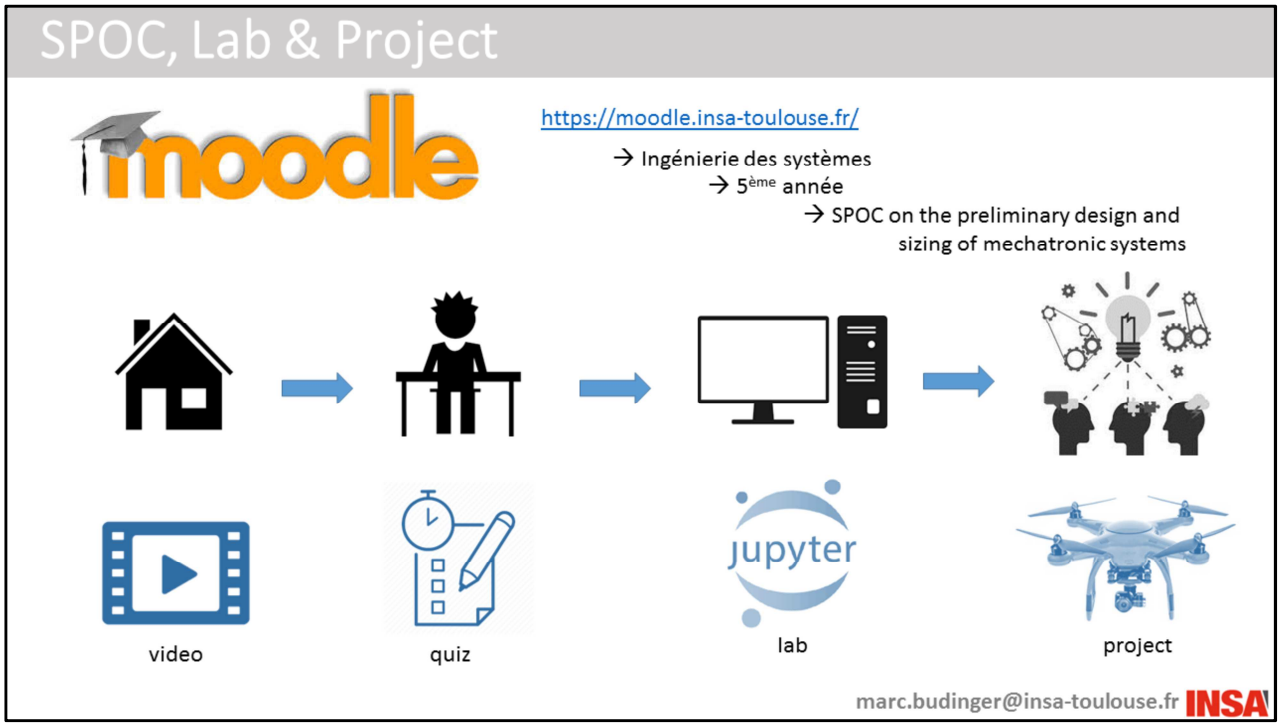
In what technical areas?
Hydraulic, electrical and mechanical systems with a focus on drive and actuation systems.

With which approaches?
Graphs, Scaling Laws, Meta Models, Design of Experiments and Optimization

With which software ?
Python, Excel, Modelica

Concerning the organisation of this module:
This module will have 30 hours of class contact and contains : videos like this one in order to present to you the main elements of this course, 6 sessions with the whole class to go through the topics shown in the videos using small examples, work sessions and a final project concerning the sizing of a power system.
This course's evaluation will be based on 2 marks: a personal mark from a written exam and a group mark for the final project.

Concerning the topics of this module:
-The main objectives are to be able to size and optimize multi domain power transmissions.
-The technical areas concern hydraulics, electricity and mechanics with examples which are mainly actuation systems or drive systems.
-These approaches will make you discover what are scaling laws, metamodels or design graphs.
-The implementation of the model will be done using python but can also come from Modelica models or excel sheets.

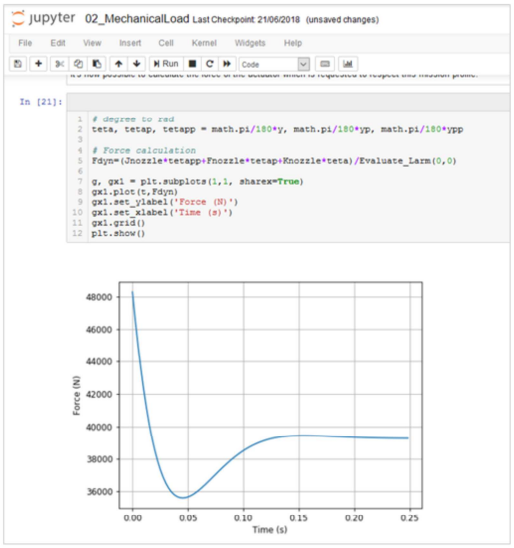


This moodle page is a SPOC (Small Private Online Course) on the preliminary design and sizing of mechatronic systems.
Here you will find videos, quiz and tutorials about models and methods for selecting the components of a multi-domain power transmission.

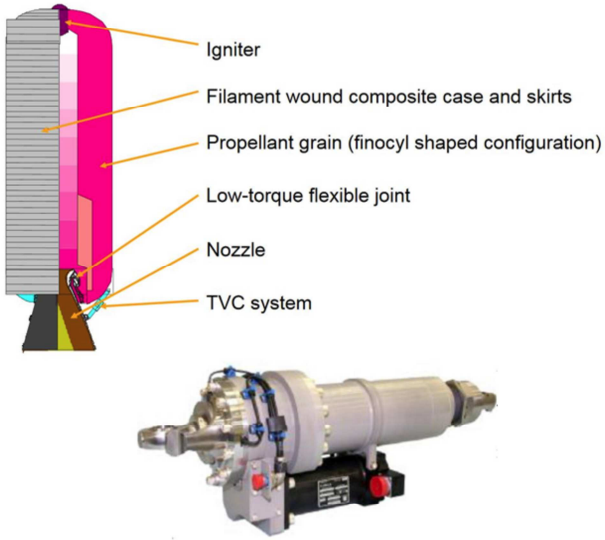
- At home: read written materials and watch videos
- During lectures: quiz & questions
- During Lab: practical applications on a case of study
- During project: team work on a sizing project

Labs

Jupyter notebook (Python)



Preliminary design of a thrust vector control actuator (TVCA)



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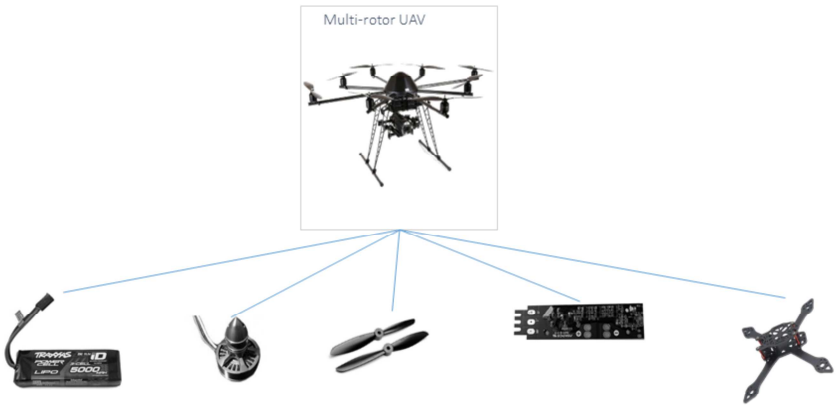
The labs are based on Jupyter notebooks: this set of documents aims at to give an introduction on the use of Python and Jupyter notebooks for the preliminary design of actuations systems.
This case study is inspired by an electromechanical actuation system used to control the thrust vector of the VEGA launcher.

Project (1)



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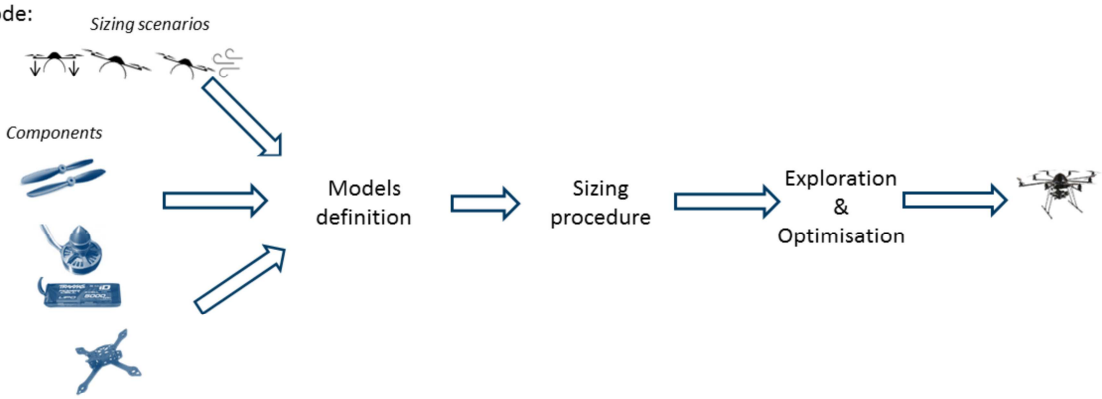
Project (2)

Sizing code:



Evaluation of the sizing code on multiple specifications:

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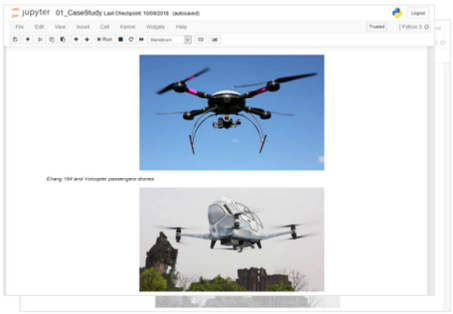
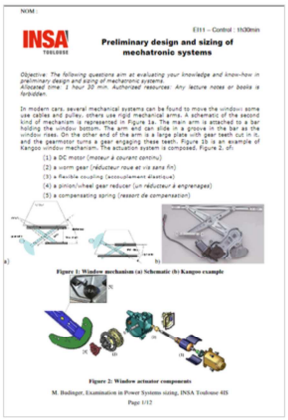
Evaluation

Project (report+activity) :



A set of Jupyter Notebooks with active and usable python codes

Written exam:



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