

# SA402 - Flexible structure dynamics: modeling and control

From the Advanced Master AES  
(Aeronautical & Space Structures)



## Highlights

- Flexible structure modeling
- Lagrange equations
- Experimental case study

## Key elements

Dates:  
**9 - 19 November 2021**

Duration: **20 hours**

For whom:  
**recent graduates, jobseekers  
and experienced employees**

Location:  
**ISAE-SUPAERO, Toulouse**

Course fees: **2 000 €**

Language: **English**

This course will bring you a unique insight in the modelling of flexible structures and the theory of linear servo-control.

## Prerequisites

- Good knowledge of general mechanics, vibration mechanics and linear algebra

## Learning objectives

After completing this course, participants will be able to:

- Apply the principles of linear servo-control and flexible structure modeling (aerospace vehicles).
- Analyze the vibratory behavior in open and closed loop on a control law.
- Implement them under MATLAB/SIMULINK.

## Practical information and registration

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## Course content

Modelling of flexible structures:

- Lagrange equations,
- notions of effective masses,
- Sub-structuring: connection of a flexible appendix to a central body,
- modal analysis of flexible structures,
- co-location of actuators/sensors,
- model reduction.

Theory of linear servo-control:

- transfer function/state representation,
- modal analysis, root location,
- frequency analysis, stability margins,
- gain/phase control of flexible modes.

Case studies:

- modelling and analysis of an experimental flexible structure:  
[https://personnel.isae-superaero.fr/IMG/mpg/film\\_bamoss\\_ve.mpg](https://personnel.isae-superaero.fr/IMG/mpg/film_bamoss_ve.mpg)
- reduction of an aircraft model for the synthesis of lateral flight controls

## Teaching methods

Teaching methods	Yes
Lectures / tutorial	X
Collaborative learning	
Flipped classroom	
Blended learning (online and face to face)	
Learning by doing	X
Project-based	
Simulation	
Case study	X

## Assessment

Marked seminar