Course Project Guidelines

System Modeling and Analysis

ME 375

25%

Semester: Spring 22

Contents

I. Introduction

This project is intended to demonstrate students' ability to analyse vibration and control systems based on specified requirements applying the knowledge they learned from the class. In addition to applying technical knowledge in a 'real world' project, this would demonstrate the students' ability to conduct group research, teamwork, technical data interpretation, report writing and project management skills.

Accordingly, students are required to formulate groups of 3 members.

II. Learning Outcomes

The project covers the learning outcomes described in the course syllabus (Refer to the syllabus for more details) and concentrate mainly in the application of the following experiences:

- Develop an understanding of dynamic behavior of a structure (1)
- Foster effective mathematical and graphical communication skills (3)
- Function on teams (5)

III. Project Summary (Scenario)

You are asked to study and analyze the Airbus A320 wing shown in figure 1 and figure 2. Your objective is to develop a first-order spring-mass system which consists of a spring and a mass element that model the left wing of the A320 aircraft.

Apply the System Modeling and Analysis knowledge to simplify the real mechanical system to make an idealized model (develop the kinetic diagram of the wing), interconnected elements in the mechanical model, apply physical laws such as Newton's laws and the conservation of energy, evaluate the natural frequency of the wing in 2 configurations.

To succeed your mission you should complete the dynamic analysis as mentioned in Deliverable 1.

Consider/Assume:

- **The Airbus A320 is equipped with a 2 tons weight CFM56-5B Jet Engine.**
- **The wing as a rectangular profile**.

Figure 1: Airbus A320

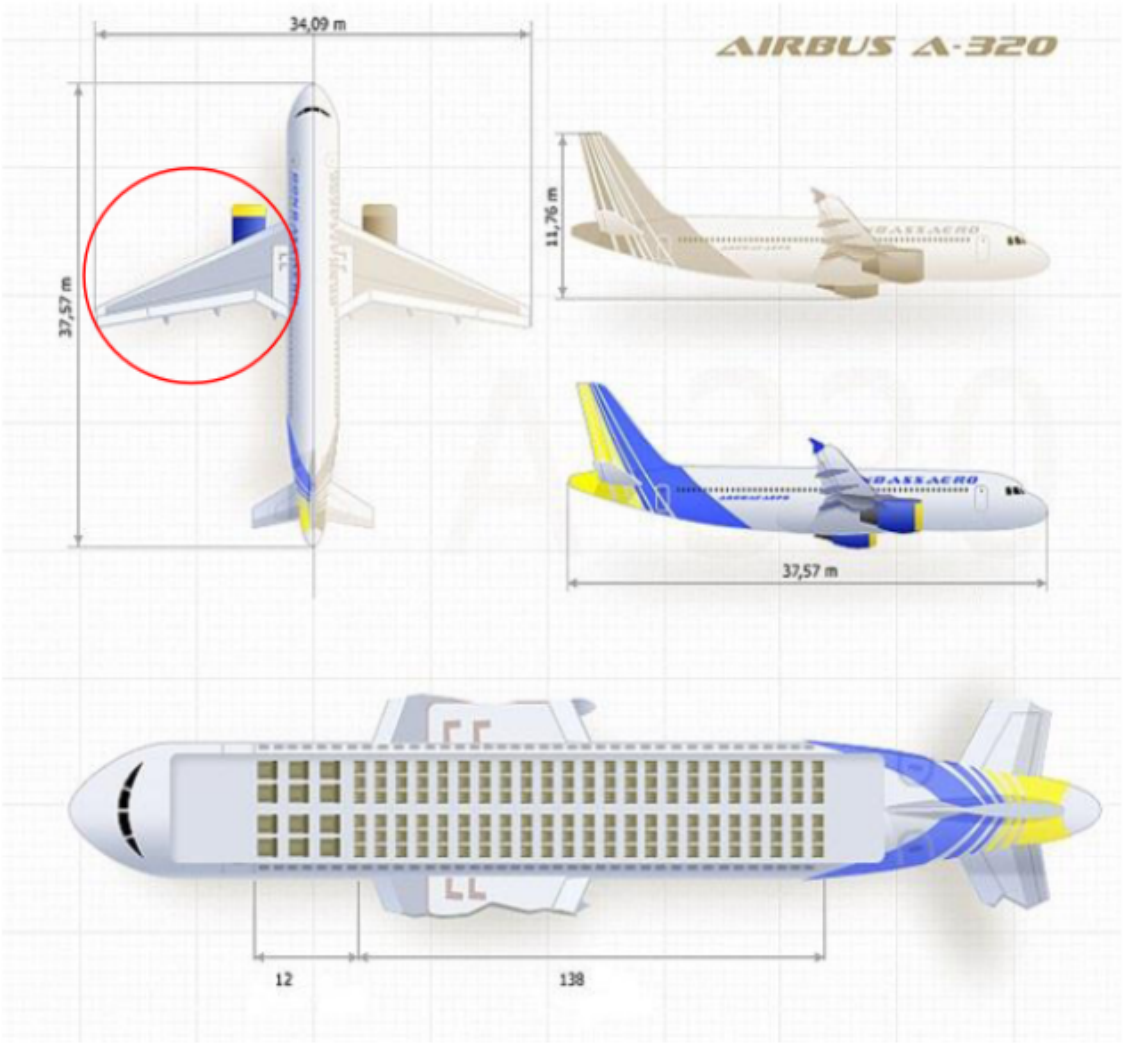

Figure 2: Airbus A320 Main Dimensions.

Deliverable 1:

1. Describe the problem without addressing any possible solutions – Problem definition.
2. Conduct research to complete properly any missing data or dimension and draw the sketch of the A320 wing with dimensions.
3. Create a simplified kinetic diagram of the wing indicating different stiffness expression and mass value.
4. Consider two studies to define the mass value:
    a. The fuel tank is full,
    b. The fuel tank is almost empty.

    Useful link: https://www.youtube.com/watch?v=Cy3HnP6nf0c
5. Conduct research and gather information to determine the materials used.
6. Show the properties of the selected material in a table.
7. Consider the wings as fixed at the fuselage and apply required System Modeling and Analysis:
    a. Write the equation of motion,
    b. Find the Laplace domain equation with inserting the given parameters,
    c. Calculate the natural frequency of the system,
    d. Assume the Initial Conditions,
    e. Find time domain using inverse Laplace transform.
8. Explain how individual members have contributed using a Gantt chart.

Deliverable 2:

1. A PowerPoint presentation of the Deliverable 1 – each member to reflect their own contribution and how they have collaborated with team members.

IV. Deliverables & Project Management

Deliverables		Deadline	Method of Delivery	Grade Allocated
	Groups of 3 students should be formed with one team leader and names submitted to the instructor.	**Apr. 7th 2022**		
Deliverable 1 Report	A report (10 to 15 pages) describing your work based on the project requirements mentioned above.	**May 10th 2020 (midnight)**	Upload the final report **(typed in a word document / only equations can be handwritten)** on Moodle on the specified link	**15%**
Deliverable 2 Presentation	Power Point slides and a short presentation describing your work in 5 minutes max.	**Week 14**	Upload the Power-Point presentation on Moodle and individual in class discussion during W14 (lecture time)	**10%**
			Total	**25%**

V. Plagiarism

- Upon suspicion and doubt of the authenticity of the work submitted, the Instructor has the right to ask the student to verify her/his work. This can be done through, but not limited to, oral examination or discussion, or any other action deemed necessary. If the student fails to prove the authenticity of the work, then the Instructor will apply the academic misconduct rules as mentioned in the AUM Student Handbook which may include awarding the work a zero grade.
- You will also be held responsible if someone else copies your work - unless you can demonstrate that you have taken reasonable precautions against copying.
- For a detailed description of academic misconduct please refer to the undergraduate AUM Student Handbook.

VI. Marking Scheme

Deliverables	90-100%	80-90%	60-80%
D1	Outstanding study and a full design report which includes all elements	Satisfactorily written report includes all elements	Poorly written report includes some of the elements
D2	Excellent presentation, answered all questions	Satisfactory presentation , answered most questions	Weak presentation, answered few/no questions