

AE2223-2 Experimental Research 2020 – Assignment 1

This is the first group assignment on the topic Experimental Research in the course AE2223-2. It contributes 10% towards your final grade and is a group grade.

INSTRUCTIONS

You must complete this assignment jointly with the students in your group in course AE2223-2. The assignment has been divided in 4 questions so that you can work in sub-groups of 2-3 students on the different questions.

Title page. 1 page. On the front cover of the assignment, you must include the following information:

- Course Number and Name
- Assignment Number
- Your Group Name
- Student IDs and Names of all students in your group
- Brief description of the contribution of each student the group to completing the assignment.

Answer pages.

- Start each answer on a new page
- Required length per question is between 1½ and 3 pages
- You are expected to research your own material to answer some parts of the questions
- You may include pictures, graphs if it helps in answering the question

References

- You are expected to include references to your sources
- Maximum of 1 page for references

ASSIGNMENT QUESTIONS

Q1a. Truth (25% of assignment grade)

This question explores the role of mathematics in aerospace engineering:

- When did mathematics start to be used in aviation? Take several examples from the early days of flight and argue either for or against the importance of mathematics in aviation in this time period.
- Does the development of new control algorithms originate in mathematics or in the application. Explain your answer.
- Are the control algorithms you have learnt in BSc Aerospace Engineering literally true? Explain.
- Give an example of how space flight has contributed to the development of a new mathematical theory. Give sufficient detail to argue the validity of your answer.

Q1b. Parsimony Principle (25% of assignment grade)

This question is about the relevance of the parsimony principle in fatigue.

- Give a definition of the parsimony principle.
- Consider the example of fatigue testing of a simple aluminium dog-bone test coupon at 5 different stress levels. What information would you obtain if you investigated a linear relationship between stress and number of cycles to failure? *Hint: It is helpful to include a plot showing the relationship.*
- Use the parsimony principle to find the simplest relationship between the stress and number of cycles to failure. Explain why it is the simplest relationship. *Hint: You may like to divide the number of cycles axis into different regions.*
- Is the relationship you presented in the previous sub-question literally true? Explain.

Q1c. Experimentation (25% of assignment grade)

In this question you will consider the different types of experiment.

- Give definitions of observation, prospective and retrospective experiments.
- Give an example of an observation experiment in aerodynamics. Explain why this type of experiment is most suitable for this hypothesis.
- How would you use retrospective experimentation in aircraft manufacturing to improve efficiency and reduce production costs? Give sufficient detail to justify the selection of your example.
- How can you use prospective experimental in numerical modelling of composite structures? Explain if it would be possible to investigate the same hypothesis using observation or with a retrospective study in numerical modelling.

Q1d. Magic (25% of assignment grade)

Give an example of thought experiment that uses a 'magic' component or property in each of the three topics areas below. For each example justify that you are able to gain insight into an aspect of aerospace or wind energy design

1. Aerodynamics in wind energy
2. Efficient movement of passengers in an airport
3. Cubesat

DEADLINE:

Sunday 1st March 2020 at midnight (24:00)

DELIVERY

Answer all questions in the assignment and complete a written report, using figures if necessary. The report must be uploaded as a PDF to Blackboard by the deadline.