ME40358 – Assessment 1b

Design of Experiments 2020/21

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Background Information

You work for a small wind turbine manufacturer and this company produces a product that has the same internal workings as the 'Mini Wind Turbine' rigs in your equipment sets. As part of there product improvement effort, they wish to conduct a Factorial Design of Experiments to identify significant factors (and interactions) that influence the rotor RPM, which is proportional to the measured voltage from the DC motor/generator.

Part 1 of the Assignment

Working as an individual or as part of a partnership, you must complete the following steps:

i. Conduct some initial research to determine three factors that are likely to impact the rotor RPM. Examples include, but are by no means limited to: number of blades, chord length, blade span, etc.
ii. Having established your three factors, decide how many levels there should be for each factor. Please use either two or three levels for each factor, whilst ensuring you have a clear understanding for why you have chosen the number of levels.
iii. Plan how you will use your blade material (balsa wood for some, yellow plastic for others). Please note that material is expensive and precious. Therefore, you will not be issued any more material.
iv. Based on the instructions from today's lecture and slide deck, plan your full factorial design of experiments, including all elements of experimental good practice.
v. Conduct your experiments and tabulate your data.
vi. Following the guidance in the 'ANOVA worked example video' complete your ANOVA analysis on the data to identify significant factors. You should all populate a Source of Variance Table.

Report Requirements

For this section of the Assessment 1 report, you should include the following:

i. Clearly state the aim and objectives of your experiment
ii. Provide a diagram of your experimental set-up(s), avoiding the use of labelled photographs… diagrams are always better!
iii. Clearly state your factors and the number of levels for each factor. Give a short, written justification for each choice.
iv. In an appendix, clearly show your full experimental dataset (see ANOVA worked example for sensible formats).
v. Include your Source of Variance table
vi. Which factors and interactions are significant according to the F-ratio and p-value?
vii. Discuss whether your findings agree with your initial research in terms of their significance. If they are surprising, why are they surprising? Were there any limitations in the experiment that may have led to misleading data or conclusions?