NATURAL FREQUENCY ANALYSIS OF FLUTTER PHENOMENON ON A CANTILEVER BEAM WITH AIRFOIL CROSS-SECTION MODEL

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ABSTRACT

Aircraft has been a main transportation across the globe due to its range and speed of travel. While inflight, due to the interaction between the aircraft, especially the wing, and the wind from the surrounding a resonance may occur. If said resonance do occur the wings are highly at risk of experiencing a flutter phenomenon. Flutter causes an uncontrollable vibration, at which can cause the loss of control from the pilot and a significant damage to the aircraft. To predict at which frequency flutter occur, the natural frequency of the wings must be calculated. If the frequency of wind matches the natural frequency of the wings, flutter bound to happen do to the occurrence of resonance. Methods to calculate the natural frequency of the wing are plentiful, one of which is finite element analysis (FEM). By using FEM, the wings are modeled as a cantilever beam with an airfoil cross section, and then divided as many elements. The number of elements determined the accuracy of its result. To conduct the FEM, this study used a MATLAB syntax program that run at a certain algorithm to specifically calculate natural frequency and its mode shape. As a validation, the results from FEM are compared to the Euler-Bernoulli beam theorem. The results comparison produced a maximum error of 0.383 %, this clearly below 10 % error, which is the rule of thumb of allowed error. Which means, the result from this study can be stated as relatively true. Therefore, the frequencies at which flutter will occur on this study's model are 1.498 Hz, 9.392 Hz, and 29. 296 Hz.

Key words : Flutter, Natural Frequencies, Resonance, FEM.