FINAL PROJECT

NUMERICAL AND EXPERIMENTAL STUDY OF STATIC AND DYNAMIC CHARACTERISTICS OF COMPOSITE MATERIALS

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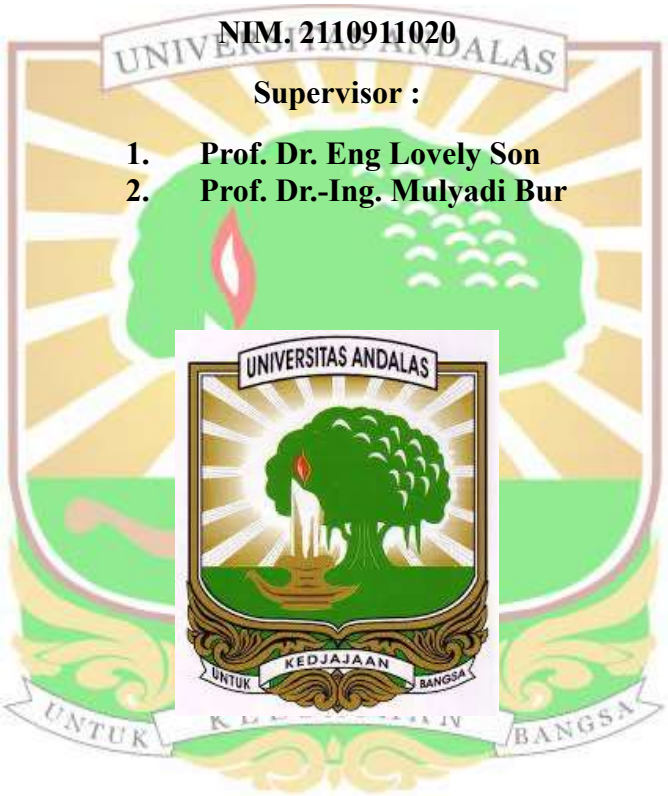

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ABSTRACT

Every construction structure considers the effect of vibration on the structure, one of which is the rapid development of technology that requires structural materials that are light, strong, and have good dynamic characteristics to improve system efficiency and performance, for example in Unmanned Aerial Vehicles (UAVs), trains, and cars. Composite materials are a superior alternative because they can have high strength and can dampen vibrations. This study aims to evaluate the effect of variations in fiber types (carbon fiber and glass fiber) and resin types (epoxy and polyester-vinylester blends) on the dynamic characteristics of composite structures. The method used is free vibration testing based on ASTM E-756 through simulation and experimentation. Numerical analysis was carried out using MSC Nastran-Patran software to obtain natural frequency values, which were then validated with experimental test results.

The results show that natural frequencies increase from the first to the third vibration mode. Both simulation and experimental results indicate that the combination of carbon fiber with polyester–vinylester resin (CPV) exhibits the highest tensile strength and natural frequency, at 2913 MPa and 86.29 Hz, respectively, followed by CE, KE, and KPV combinations. Other that, the CE combination has the highest damping ratio. The damping ratio of CE is 0.1. The numerical simulation results then compared to the experimental data, indicating the validity of the simulation approach. Overall, it can be concluded that the CPV composite material is suitable for applications due to its high strength, high natural frequency, and excellent damping performance.

Keywords: Composite materials, dynamic analisys, vibration test, natural frequency, damping ratio.