1. INTRODUCTION

1.1 Background

The Sikumbang Api AFRG is a drone/ Unmanned Aerial Vehicle (UAV) developed by the Andalas Flying Robot Generation (AFRG) team. It is a type of multirotor drone with four rotors configuration (Quadcopter). It is designed to carry loads and perform drops at predetermined locations, and it is equipped with a camera for reading QR codes. Therefore, achieving a high level of flight quality is crucial to ensure precise loads placement and successful QR code reading. Flight stability and minimal vibration are crucial for the quality of UAV operations. However, flight tests revealed several problems, including instability, part fractures, loose bolts, detached electrical casings, and imprecise dropping mechanisms. These issues were primarily attributed to inadequate vibration control and resonance. [1].

The vibrations in a quadcopter are primarily generated by the rotation of its propellers and rotors, which produce vibrations at specific disturbance frequencies. If these disturbance frequencies match the quadcopter's natural frequency, resonance can occur. This resonance can cause structural damage, disrupt the UAV's operations, and interfere with onboard electronic devices. [2].

While vibrations in UAVs cannot be entirely eliminated, they can be minimized to reduce their impact [3]. There are several methods to decrease vibrations or prevent resonance. However, due to certain limitations of the Sikumbang Api AFRG, such as reliance on thrust, weight constraints, battery usage, space limitations, and production costs, adding damping components is a feasible solution [1]. This research will analyze the vibrations in the frame of the Sikumbang Api AFRG UAV and investigate the effects of incorporating damping.

1.2 Problem Identification

Resonance occurs when the natural frequency of the quadcopter is equal to the frequency generated by the rotor-propeller. It will have an impact on the structure, electronic devices, and flight quality of the quadcopter. The addition of dampers can

be one way to overcome these problems. This study will examine the effect of adding damping material on the frequency response of the quadcopter frame.

1.3 Aims

The objectives of this research are to obtain the natural frequency and vibration response of the quadcopter frame with and without damper. In addition, this research also conducted to compare natural frequencies of quadcopter frame obtained from the experimental results and simulations.

1.4 Benefits

The benefits of this research are to reduce the vibration level of the quadcopter, prevent resonance to keep the frame structure and electronics safe and as a reference in the development of quadcopter structures to prevent failures due to resonance.

1.5 Problem Scope

a) The object studied is a quadcopter frame.
b) The research is limited to a laboratory experiment.
c) This research only focuses on the effect of adding dampers on natural frequency and vibration response values.
d) All materials are assumed to be homogeneous.
e) The quadcopter structure is assumed to be glued.

1.6 Report Outline

This final project is organized into five chapters. Chapter 1 introduces the project, covering the background, problem formulation, objectives, benefits, scope, and thesis outline. Chapter 2 reviews the literature, presenting relevant theories that support the project. Chapter 3 details the research methodology, including the research scheme, quadcopter design, and the setup for modal analysis and experimental instruments. Chapter 4 discusses the analysis and results from both simulations and experiments. Finally, Chapter 5 presents the conclusions drawn from the research.