MECHANICAL ENERGY HARVESTING ANALYSIS USING WHEEL ROTATION-BASED DC GENERATOR WITH MATLAB R2024a SIMULATION

Audha Fitrah Aulina, S.T., M.T. *as a supervising lecturer*

Sigit Firgo

Automotive Engineering Study Program

Majoring of Engineering

ABSTRACT

This research is motivated by the development of energy harvesting technology as an effort to utilize mechanical energy that was previously wasted, into electrical energy that can be reused. One potential source of mechanical energy is wheel rotation that is converted using a DC generator. This study aims to analyze mechanical energy harvesting using a wheel rotation-based DC generator through a simulation of MATLAB/Simulink R2024a. The method used is a simulation-based quantitative method with variations in rotational speed represented in speeds of 20 km/h, 30 km/h, and 40 km/h. The modeled system consists of a wheel rotation source, a 1:3 pulley ratio, a DC generator, a DC-DC boost converter, and a battery as an energy storage load. The parameters analyzed include voltage, current, electrical power, mechanical power, and efficiency. The results showed that the increase in the speed of wheel rotation caused an increase in the mechanical power of the generator from 21.55 W, 72.34 W and 149.8 W, and the electrical power also increased with the increase in speed of 11 W, 26.18 W and 41.33 W. The efficiency obtained was 51.04%, 36.19% and 27.59%. The output voltage tends to be stable at 51.92 – 51.99 V due to the influence of the DC-DC boost converter. The decrease in efficiency is affected by losses in the DC generator and boost converter during the energy conversion process. These results suggest that harvesting mechanical energy using a wheel rotation-based DC generator has the potential as an additional energy source that can be further developed.

Keywords*: energy harvesting*, *DC generator, MATLAB/Simulink*, *power*, *efficiency*