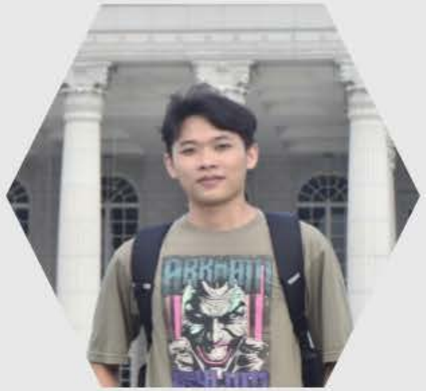
A Study on Liquid-cooled Jackets for Synchronous Reluctance Motors and Application of Machine Learning in Cooling Strategies.



Hoang Khan Nguyen

Automotive and Advanced Transportation Engineering

School of Engineering, KMITL

Asst. Prof. Dr. Chinda Charoenphonphanich

Project Partner : National Electronics and Computer Technology Center

Objective

This study evaluates the factors influencing the cooling system of synchronous reluctance motors in electric motorcycles through experiments and simulations. Subsequently, Machine Learning (ML) is trained using data on inlet temperature, motor torque, and flow rate to control the cooling strategy of the pump motor. The effectiveness is validated based on the World Motorcycle Test Cycle (WMTC) in the Matlab/Simulink environment.

Result

The water-cooling jacket effectively reduced temperatures in both the winding and the jacket. The process of collecting experimental data for simulation input parameters was reliable. Temperature fluctuations were influenced by the supplied current and flow rate. A longer water path enhanced the heat transfer coefficient, thus reducing the maximum temperature. Increasing the flow rate also decreased the maximum temperature, albeit with diminishing returns beyond a certain value. In this case, ML was utilized as an optimal control method for the water pump to consistently select a suitable flow rate that balances effective cooling with minimal waste of pump power.