

ABSTRAK

Micro Electric vehicle (MEVi) memiliki kapasitas energi yang relatif terbatas sehingga konsumsi daya subsistem pendukung, termasuk *Electric Power Steering* (EPS), perlu dianalisis untuk mendukung perencanaan energi kendaraan. Penelitian ini bertujuan menganalisis karakteristik konsumsi daya EPS pada MEVi serta menentukan rekomendasi kapasitas baterai berdasarkan pembebanan dinamis. Pengujian dilakukan dengan memvariasikan kondisi lintasan, beban kendaraan, tekanan ban, kecepatan kendaraan, dan sudut kemudi. Data arus dan tegangan direkam menggunakan HIOKI LR8513 *Wireless Clamp Logger* dan HIOKI CM7290, kemudian dianalisis menggunakan regresi, *Analysis of Variance* (ANOVA), dan visualisasi *3D Surface*. Hasil pengujian menunjukkan bahwa konsumsi arus dan daya meningkat seiring peningkatan beban kendaraan dan sudut kemudi, sedangkan peningkatan kecepatan, tekanan ban, dan kemiringan menuju kondisi tanjakan menurunkan konsumsi kelistrikan EPS. Model menghasilkan R^2 sebesar 0,9427 untuk daya dan 0,9431 untuk arus. Kondisi operasional paling efisien diperoleh pada beban 50 kg, tekanan ban 39 psi, kecepatan 12 km/jam, kemiringan 2,5°, dan sudut kemudi 7°, dengan arus 5,307 A dan daya 66,874 W. Berdasarkan *duty cycle* manuver 15% dan waktu operasional 4 jam, kebutuhan energi riil EPS sebesar 90,28 Wh dengan kapasitas minimum baterai 7,52 Ah. Konfigurasi baterai LiFePO4 4S2P menghasilkan kapasitas 8 Ah pada tegangan nominal 12,8 V dan direkomendasikan untuk sistem EPS MEVi.

Kata Kunci: *Electric Power Steering*, *Micro Electric vehicle*, konsumsi daya, pembebanan dinamis, *battery sizing*, LiFePO4



ABSTRACT

Micro Electric Vehicle (MEVi) has relatively limited energy capacity; therefore, the power consumption of auxiliary subsystems, including *Electric Power Steering* (EPS), needs to be analyzed to support vehicle energy planning. This study aims to analyze the power consumption characteristics of EPS on MEVi and determine the recommended battery capacity under dynamic loading conditions. The experiments were conducted by varying road conditions, vehicle load, tire pressure, vehicle speed, and steering angle. Current and voltage data were recorded using a HIOKI LR8513 *Wireless Clamp Logger* and HIOKI CM7290, then analyzed using regression, *Analysis of Variance* (ANOVA), and *3D Surface* visualization. The results show that current and power consumption increase with increasing vehicle load and steering angle, while higher vehicle speed, tire pressure, and road inclination toward uphill conditions reduce EPS electrical consumption. The models achieved R^2 values of 0.9427 for power and 0.9431 for current. The most efficient operating condition was obtained at a vehicle load of 50 kg, tire pressure of 39 psi, speed of 12 km/h, road inclination of 2.5° , and steering angle of 7° , resulting in a current of 5.307 A and power consumption of 66.874 W. Based on a 15% steering maneuver *duty cycle* and a 4-hour operating duration, the EPS requires 90.28 Wh of actual energy with a minimum battery capacity of 7.52 Ah. A 4S2P LiFePO₄ battery configuration provides a capacity of 8 Ah at a nominal voltage of 12.8 V and is recommended as the power source for the MEVi EPS system.

Keywords: *Electric Power Steering*, *Micro Electric Vehicle*, power consumption, dynamic loading, battery sizing, LiFePO₄

