

Disain Strategi Manajemen Daya Berbasis Equivalent Consumption Minimization Strategy (ECMS) pada Kereta Hibrida = Design of Energy Management System Base on Equivalent Consumption Minimization Strategy for Hybrid Train

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Abstrak

Kereta hibrida telah menjadi fokus penelitian dalam upaya meningkatkan efisiensi energi dan mengurangi emisi gas buang dengan cara meminimalkan penggunaan diesel. Penelitian ini menyajikan perancangan strategi manajemen daya adaptif berbasis Equivalent Consumption Minimization Strategy (ECMS) dengan memanfaatkan informasi prediksi daya dari jaringan saraf tiruan Long Short-Term Memory (LSTM). Strategi ECMS dirancang untuk mengoptimalkan persamaan konsumsi bahan bakar yang merupakan kombinasi dari konsumsi bahan bakar dan daya listrik yang dihasilkan oleh baterai melalui informasi prediksi daya beban dan SOC baterai. Prediksi daya beban didapatkan melalui masukan data kecepatan dan ketinggian kereta. Setelah menerapkan strategi dan melakukan simulasi, disimpulkan bahwa strategi mampu bekerja dengan baik pada saat SOC baterai dalam kondisi optimal. Pada SOC awal sebesar 90%, penggunaan diesel mampu ditekan hanya sebesar 18.94% sepanjang siklus pengujian.

.....Hybrid trains have emerged as a focal point of research endeavors aimed at enhancing energy efficiency and mitigating exhaust gas emissions by minimizing diesel usage. This study presents the design of an adaptive power management strategy based on Equivalent Consumption Minimization Strategy (ECMS), leveraging power prediction information from Long Short-Term Memory (LSTM) artificial neural networks. The ECMS strategy is formulated to optimize the fuel consumption equation, a combination of fuel consumption and electric power generated by the battery, using predicted load power and battery State of Charge (SOC) information. Load power predictions are obtained through input data consisting of train speed and elevation. Upon implementing the strategy and conducting simulations, it is concluded that the proposed strategy performs effectively when the battery SOC is in optimal conditions. Starting with an initial SOC of 90%, diesel usage could be reduced by only 18.94% throughout the testing cycle.