

ABSTRAK

Sigit Irawan: Analisis Pengaruh Pemasangan Filter Pasif Akibat Penggunaan ELC (*Electronic Load Controller*) PLTMH Suka Sama, Kecamatan Sibolangit. Skripsi. Fakultas Teknik Universitas Negeri Medan, 2025.

PLTMH merupakan solusi efisien untuk penyediaan energi di daerah terpencil, namun penggunaan *Electronic Load Controller* (ELC) menimbulkan harmonisa akibat komponen nonlinier, yang berdampak pada penurunan kualitas daya dan peningkatan suhu belitan stator. Penelitian ini bertujuan menganalisis pengaruh pemasangan filter pasif jenis *single tuned* dan *double tuned* terhadap reduksi harmonisa arus pada PLTMH Suka Sama. Simulasi dilakukan menggunakan MATLAB/Simulink berdasarkan data harmonisa arus hasil pengukuran. Hasil penelitian menunjukkan bahwa pada kondisi tanpa filter, nilai THDi pada fasa R, S, dan T masing-masing adalah 23,52%, 22,97%, dan 23,35%. Setelah penggunaan *single tuned filter*, nilai THDi menurun menjadi 10,18% (R), 9,88% (S), dan 10,07% (T). Sedangkan penggunaan *double tuned filter* menghasilkan penurunan THDi lebih lanjut menjadi 8,94% (R), 8,75% (S), dan 8,86% (T). Dari segi peningkatan suhu belitan stator, pemasangan filter pasif juga memberikan dampak positif dengan menurunkan suhu rata-rata dari 60,14°C tanpa filter menjadi 51,31°C dengan *single tuned* dan 49,57°C dengan *double tuned*. baik *single tuned filter* maupun *double tuned filter* efektif dalam mereduksi harmonisa arus yang ditimbulkan oleh ELC. Namun, *double tuned filter* memberikan performa yang lebih baik, baik dalam menurunkan nilai THDi maupun dalam menekan kenaikan suhu belitan stator. Penelitian ini memberikan kontribusi terhadap peningkatan kualitas daya dan keandalan sistem pembangkit mikrohidro berbasis ELC di daerah terpencil. Penelitian ini diharapkan menjadi referensi dalam penerapan filter pasif sebagai solusi pereduksi harmonisa pada sistem pembangkit mikrohidro dengan ELC.

Kata Kunci: ELC, PLTMH, Filter Pasif, *Single Tuned*, *Double Tuned*, THDi, MATLAB Simulink.



ABSTRACT

Sigit Irawan: Analysis of the Impact of Passive Filter Installation Due to the Use of ELC (Electronic Load Controller) at PLTMH Suka Sama, Sibolangit District. Undergraduate Thesis. Faculty of Engineering, Universitas Negeri Medan, 2025.

Micro hydro power plants (PLTMH) offer an efficient solution for electricity supply in remote areas. However, the use of Electronic Load Controllers (ELC) introduces harmonic distortions due to their nonlinear components, which negatively affect power quality and increase the stator winding temperature of synchronous generators. This study aims to analyze the effect of installing passive filters single tuned and double tuned on reducing harmonic currents in PLTMH Suka Sama. The simulation was carried out using MATLAB/Simulink, based on measured harmonic current data. The results showed that under conditions without filters, THDi values for phases R, S, and T were 23.52%, 22.97%, and 23.35%, respectively. With the installation of a single tuned filter, THDi was reduced to 10.18% (R), 9.88% (S), and 10.07% (T), while the use of a double tuned filter further reduced THDi to 8.94% (R), 8.75% (S), and 8.86% (T). In terms of stator winding temperature, the filters also had a positive impact, lowering the average temperature from 60.14°C (without filter) to 51.31°C (single tuned) and 49.57°C (double tuned). Both filters were effective in reducing harmonics generated by the ELC, but the double tuned filter provided superior performance in minimizing THDi and controlling temperature rise. This research contributes to improving power quality and system reliability in micro-hydro power plants using ELC and is expected to serve as a reference for implementing passive filters as a harmonic mitigation solution..

Keywords: ELC, PLTMH, Passive Filter, Single Tuned, Double Tuned, THDi, MATLAB Simulink.

