

RINGKASAN

ANALISIS UNJUK KERJA OPERASI PARALEL MULTI INVERTER SUMBER TEGANGAN TIGA TINGKAT UNTUK PANEL SURYA STAND-ALONE DILENGKAPI MPPT

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Pengembangan pembangkit listrik tenaga surya (PLTS) semakin ditingkatkan guna mengurangi penggunaan energi listrik dari pembangkit listrik konvensional. Energi listrik yang dihasilkan dari tenaga surya berupa listrik DC, sedangkan kebanyakan alat - alat elektronik yang digunakan pada jaringan listrik menggunakan listrik AC. Oleh karena itu, dengan menghubungkan beberapa inverter sumber tegangan (*Voltage Source Inverter/VSI*) secara paralel, maka listrik DC dapat dikonversi menjadi listrik AC dalam jumlah yang besar. Penggunaan VSI dipilih karena VSI lebih tinggi dalam efisiensi dibandingkan dengan CSI. Selain itu, guna meningkatkan efisiensi daya dari PLTS, MPPT juga diperlukan untuk mengatasi daya keluaran yang non-linier dari PLTS. Penelitian ini bertujuan untuk mengetahui karakteristik arus keluaran, tegangan, faktor daya, efisiensi dan THD dari operasi paralel multi Inverter sumber tegangan yang dilengkapi MPPT.

Metode penelitian dilakukan dengan cara mensimulasikan rangkaian multi paralel inverter sumber tegangan dilengkapi MPPT pada aplikasi PSIM guna mengetahui unjuk kerja dari rangkaian. Penelitian dilakukan dalam empat kondisi, kondisi pertama saat iradiasi masing-masing panel surya sama dan arus referensi masing-masing inverter sama, kondisi kedua saat iradiasi masing-masing panel surya sama dan arus referensi masing-masing inverter berbeda, kondisi ketiga saat iradiasi masing-masing panel surya berbeda dan arus referensi masing-masing inverter sama, kondisi keempat saat iradiasi masing-masing panel surya berbeda dan arus referensi masing-masing inverter berbeda.

Dari keempat kondisi pengujian yang dilakukan, diketahui bahwa sistem MPPT yang digunakan mampu mempertahankan daya keluaran panel surya tetap pada daya maksimum nya dan juga diperoleh nilai THD dari arus inverter, arus beban dan tegangan beban yang kecil meskipun pada kondisi faktor daya yang berbeda-beda. Pada pengujian efisiensi daya diperoleh efisiensi daya tertinggi pada kondisi pengujian pertama dan keempat, yaitu maksimum disekitar 98%. Sementara pada kondisi pengujian kedua dan ketiga diperoleh efisiensi daya maksimum hanya disekitar 60%.

Kata kunci : PLTS, Unjuk Kerja, Operasi Paralel, VSI, MPPT, THD, Efisiensi

SUMMARY

PERFORMANCE ANALYSIS OF PARALLEL OPERATIONS MULTI THREE-LEVEL VOLTAGE SOURCE INVERTER FOR STAND-ALONE SOLAR PANELS WITH MPPT

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The development of solar power plants (PLTS) is increasingly being increased in order to reduce the use of electrical energy from conventional power plants. Electrical energy generated from solar power is in the form of DC electricity, while most electronic devices used in the electricity network use AC electricity. Therefore, by connecting several voltage source inverters (VSI) in parallel, DC electricity can be converted into large amounts of AC electricity. The use of VSI was chosen because VSI is higher in efficiency compared to CSI. In addition, in order to increase the power efficiency of solar panel, MPPT is also needed to overcome the non-linear output power of solar panel. This study aims to determine the characteristics of the output current, voltage, power factor, efficiency and THD of the parallel operation of a multi-voltage inverter equipped with MPPT.

The research method is carried out by simulating a multi-parallel inverter circuit with a voltage source equipped with MPPT on the PSIM application to determine the performance of the circuit. The research was carried out under four conditions, the first condition was when the irradiation of each solar panel was the same and the reference current of each inverter was the same, the second condition was when the irradiation of each solar panel was the same and the reference current of each inverter was different, the third condition was when the irradiation of each was different. each solar panel is different and the reference current of each inverter is the same, the fourth condition when the irradiation of each solar panel is different and the reference current of each inverter is different.

From the four test conditions carried out, it is known that the MPPT system used is able to maintain the solar panel output power at its maximum power and also obtain the THD value of the inverter current, load current and load voltage which is small even at different power factor conditions. In the power efficiency test, the highest power efficiency was obtained in the first and fourth test conditions, which was a maximum of around 98%. Meanwhile, in the second and third test conditions, the maximum power efficiency is only around 60%.

Keywords : PLTS, Performance, Parallel Operation, VSI, MPPT, THD, Efficiency