IMPEDANCE ESTIMATION OF SINGLE-PHASE DIODE BRIDGE RECTIFIER USING KALMAN FILTER

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I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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Thesis submitted in fulfillment of the requirements
for the award of the degree of
Master of Science

College of Engineering

UNIVERSITI MALAYSIA PAHANG

JANUARY 2022

ACKNOWLEDGEMENTS

In the name of Allah, Most Gracious, Most Merciful

All praise is to Allah with His Guidance and Benevolence; I had successfully accomplished my master degree project. In this regard, I would like to take opportunity to thank my research supervisor, Prof. Madya Ts. Dr. Hamzah Bin Ahmad for his patience, kindness, motivating suggestions and encouragement helped me throughout this whole project.

Special thanks to my lovely husband, Mohamad Solehin Bin Zahid and my family, especially my beloved parents Encik Othman Bin Ahmad and Puan Rohani Binti Mat Jusoh for their unconditional love, endless support and sacrifice throughout my life and encouraged me to carry on my higher studies. Not forgotten my fellow friends for spending their time in helping, giving support in completing my project. Their presences indeed assist me indirectly.

Last but not least, I would like to thank all those who are involved directly and indirectly in completing this project including all the UMP lecturers and staffs for such a great help during completing my project. Finally, I would like to thank UMP for the assistance and support on this research under grant RDU160145.

ABSTRAK

Pada masa ini, sebahagian besar beban elektronik tidak linear. Ballast elektronik untuk lampu pelepasan, peralatan audio, dan komputer peribadi adalah contoh beban tidak linear. Voltan DC digunakan untuk menggerakkan beban elektronik ini. Penting untuk menukar voltan AC ke voltan DC kerana sistem pengagihan kuasa beroperasi pada voltan AC. Dalam aplikasi kuasa rendah, penerus fasa tunggal menukar elektrik AC ke voltan DC. Aspek-aspek yang mempengaruhi beban tidak linear dan memungkinkan kajian kualiti daya merangkumi faktor daya, faktor anjakan, dan penyelewengan harmonik. Kajian mengenai fenomena ini semakin popular kerana jenis beban ini menjadi lebih lazim di persekitaran kediaman dan komersial. Pemodelan beban tidak linear adalah alat penting untuk menyelesaikan masalah ini. Maka diperlukan penyelidikan khusus mengenai pemodelan beban ini. Hasilnya, kajian ini mencipta model penapis Kalman dengan menggunakan MATLAB Simulink untuk menganggar parameter RLC penerus jambatan diod satu fasa. Reka bentuk sistem dilakukan menggunakan platform MATLAB Simulink, dengan parameter RLC yang sesuai diambil dari kajian literatur yang relevan. Kajian ini mendapati bahawa jumlah kebisingan dalam sistem menunjukkan prestasi sistem. Simulasi selesai apabila semua syarat yang diperlukan dipenuhi, yang bermaksud ketepatan yang dicapai sekurang-kurangnya 90%. Jika dibandingkan dengan teknik Analisis, hasil simulasi menunjukkan bahawa kaedah yang dicadangkan lebih tepat. Ini menentukan bahawa dengan nilai kebisingan proses yang sederhana, ketepatan kapasitansi, rintangan, dan induktansi yang setara menjadi lebih tepat. Untuk Bahagian 1, peratusan ketepatan masing-masing meningkat sebanyak 0.26%, 0.6%, dan 9.84%, untuk rintangan, induktansi, dan kapasitansi. Sementara itu, untuk Bahagian 2, peratusan ketepatan masing-masing meningkat 0.16%, 0.1%, dan 1.3%, untuk rintangan, induktansi, dan kapasitansi. Akhirnya, Penapis Kalman dapat digunakan untuk mengira nilai parameter R, L, dan C untuk penerus jambatan dioda fasa tunggal. rintangan dan induktansi yang setara lebih tepat dengan nilai bunyi yang kecil. Peratusan ketepatan meningkat sekitar 0.26% untuk rintangan, sementara 0.6% untuk induktansi dan 9.84% untuk kapasitansi untuk Bahagian 1. Selanjutnya, untuk Bahagian 2, peratusan ketepatan meningkat sekitar 0.16% untuk rintangan, sementara 0.1% untuk induktansi dan 1.3 % untuk kapasitans. Sebagai kesimpulan, Kalman Filter dapat digunakan untuk menganggar nilai parameter R, L dan C untuk penyearah jambatan dioda fasa tunggal.

ABSTRACT

Today, the majority of electronic loads are non-linear. Electronic ballasts for discharge lamps, audio equipment, and personal computers are examples of non-linear loads. DC voltage is used to power these electronic loads. It is important to convert AC voltage to DC voltage since the power distribution system operates on AC voltage. In low-power applications, single phase rectifiers convert AC electricity to DC voltage. The aspects that influence nonlinear loads and allow a power quality study include power factor, displacement factor, and harmonic distortion. The study of these phenomena has grown in popularity as this type of load has become more prevalent in residential and commercial environments. Nonlinear load modeling is a critical tool for resolving this issue. Then specialized research into the modeling of these loads is required. As a result, this study create a Kalman filter model by using MATLAB Simulink for estimating the RLC parameters of a single-phase diode bridge rectifier. The system design was carried out using the MATLAB Simulink platform, with the appropriate RLC parameters taken from relevant literature studies. This study discovered that the amount of process noise in a system indicates the system's performance. The simulation is finished when all of the required conditions are met, which means the accuracy attained is at least 90%. When compared to the Analytical technique, simulation results show that the proposed method is more accurate. It specifies that with a modest value of process noise, the precision of equivalent capacitance, resistance, and inductance becomes more precise. For Section 1, the percentage of accuracy improved by 0.26%, 0.6%, and 9.84%, respectively, for resistance, inductance, and capacitance. Besides, for Section 2, the percentage of accuracy increased by 0.16%, 0.1%, and 1.3% for resistance, inductance, and capacitance respectively. Finally, the Kalman Filter can be used to calculate the R, L, and C parameter values for a single-phase diode bridge rectifier.

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