Title: Validation of Sliding Mode and Passivity Control in High-Power Quadratic Buck Converter Through Rapid Prototyping

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Abstract:
This document introduces a rapid control prototyping (RCP) approach applied to the industrial sector using a non-linear Quadratic Buck Converter (QBC) DC-DC. The goal is to reduce manufacturing costs for materials and electronic devices while enhancing the power quality in the system's response. An experimental setup is utilized to create a functional model, converting 380 VDC to 48 VDC at a power level of 500 W. dSPACE CP1103 is employed to implement Model in the Loop (MIL), Software in the Loop (SIL), and Hardware in the Loop (HIL) simulations. Modern control techniques, including sliding mode control (SMC) and passivity-based control (PBC), are employed to devise a robust control scheme capable of maintaining stability in real-time (RT) and resisting disturbances.
This approach also aligns with sustainable energy goals by contributing to the advancement of electric mobility and supporting the broader energy transition towards a greener future. The developed control strategies can be integrated into electric vehicle systems and energy management frameworks, enhancing energy efficiency and supporting the shift to renewable energy sources. The document concludes with a performance analysis, PI, Cp, CpK, Z-score, and ITAE, considering response time, signal accuracy, system stability, and resource utilization efficiency. These insights highlight the potential impact of the proposed control methods on sustainable energy practices and their role in the ongoing transition to cleaner energy solutions.

Biography:
Received a bachelor's degree in electronic engineering from Universidad Distrital Francisco José de Caldas, Colombia, in 2002, and a bachelor's degree in mathematics and systems engineering from Universidad Nacional de Colombia in 2012. He also received a Specialist degree in Teleinformatics from Universidad Distrital Francisco José de Caldas, Colombia, in 2016, and a master's degree in mechatronic engineering from Universidad Militar Nueva Granada, Colombia, in 2016. He holds a Ph.D. degree in engineering with an emphasis in electrical and electronic engineering. His research in the intelligent internet and ARMOS Groups, categorized in A1 Colciencias, Colombia.
Some of the most notable works in the resource area are:
R. A. Acosta-Rodríguez et al., "Validation of Sliding Mode and Passivity Control in High-Power Quadratic Buck Converter Through Rapid Prototyping," in IEEE Access, vol. 12, pp. 8668-8699, 2024, doi: 10.1109/ACCESS.2023.3340313.
https://ieeexplore.ieee.org/document/10347200
R. A. Acosta-Rodríguez, F. H. Martinez-Sarmiento, G. A. Múñoz-Hernandez, E. A. Portilla-Flores, and O. J. Salcedo-Parra, "Validation of Passivity-Based Control and Array PID in High-Power Quadratic Buck Converter Through Rapid

Prototyping," in IEEE Access, vol. 12, pp. 58288-58316, 2024, doi: 10.1109/ACCESS.2024.3386920.
https://ieeexplore.ieee.org/document/10496096
Rodríguez, R. A. A., Moreno, J. A. G., Castañeda, L. N. R., & Trujillo, J. (2023). Modeling and simulation of a non-linear high-power quadratic buck converter from design analysis. International Engineering Education Meeting.
https://acofipapers.org/index.php/eiei/article/view/3152
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