IAF SPACE POWER SYMPOSIUM (C3)
Interactive Presentations - IAF SPACE POWER SYMPOSIUM (IPB)

Author: Mr. Naman Vaidya
Pixxel Space Technologies, India

ADAPTIVE MODEL REFERENCE ADAPTIVE CONTROL (MRAC) BUCK CONVERTER FOR SPACEBORNE APPLICATIONS WITH SINGLE EVENT UPSET (SEU) MITIGATION

Abstract

This abstract introduces a cutting-edge approach to power management in space systems through the development of an Adaptive Model Reference Adaptive Control (MRAC) buck converter. This converter is designed to dynamically optimize its output in response to variable loads while concurrently addressing the challenges posed by Single Event Upsets (SEUs) in electronic systems. The proposed converter, constructed primarily with Commercial Off-The-Shelf (COTS) components, seeks to alleviate the escalating costs associated with space-grade components. The utilization of MRAC facilitates real-time adaptation of control parameters, enhancing the converter's efficiency under dynamic load conditions. This adaptability is crucial in space environments where fluctuating power demands are prevalent. Additionally, the converter incorporates a robust SEU detection mechanism, triggering an intelligent power cycling response upon detection. This feature ensures the system's resilience to radiation-induced upsets, further bolstering the reliability of the spaceborne electronics. This abstract delineates the theoretical foundation, design intricacies, and anticipated advantages of the adaptive MRAC-based buck converter. By embracing COTS components, the design not only addresses economic concerns but also aligns with a sustainable and accessible paradigm for space system development. The potential ramifications of this innovation span diverse space applications, contributing significantly to the progress and dependability of electronic systems in the challenging space exploration environment.