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EXPERIMENTING WITH A NEW SEQUENTIAL SWITCHING SHUNT SERIES REGULATOR (S4R) FOR COMMUNICATION SATELLITES

Abstract

In the last decades, the satellite's power requirements have been increasing together with new technologies and innovations of this field. The satellites have passed from hundreds watts to several kilowatts, requiring higher current and voltage buses. An important device in the electrical power subsystems are the shunt regulators. These devices dissipates the remaining energy from the solar array panel that is not used by the payload, and provides the necessary stability to operate as fully regulated bus. These requirements introduced new solar array panel technologies as the Gallium Arsenide, or GaAs, which can provide better efficiency but with some drawbacks for the shunt regulators. Now, the parasitic capacitance is around five times larger than the silicon technology for the same current and voltage. The impact of this parasitic capacitance represents an increased switching power losses and larger turns on delays in the shunt transistor, and problems with the steady state and dynamic response of the S4R. The purpose of this work is to present a novel approach of the sequential switching shunt series regulator (S4R), to overcome the problems just stated. The research will develop a novel S4R topology with a digital shunt (hybrid) for small satellites with a power less than 0.5kW. It was implemented a simulation and breadboarding with the topology, which were tested against different load levels. The results of the simulation and hardware showed the same dynamic response, demonstrating the similarities between both systems.