In this dissertation, a new satellite platform power architecture based on paralleled three-port DC/DC converters is proposed to reduce the total satellite power system mass. Moreover, a four-port DC/DC converter is proposed for renewable energy applications where several renewable sources are employed. Compared to the traditional two-port converter, three-port or four-port converters are classified as multi-port converters. Multi-port converters have less component count and less conversion stage than the traditional power processing solution which adopts several independent two-port converters. Due to their advantages, the multi-port converter recently attracts a lot of attention in the academia, resulting in many topologies for various applications. But all proposed topologies have at least one of the following disadvantages: 1) no bidirectional port; 2) without proper isolation; 3) too many active and passive components; 4) no soft-switching. Besides, most existing research focus on the topology investigation, but lack study on the multi-port converter's control aspects, which are actually very challenging since it is a multi-input multi-output control system and has so many cross-coupled control loops.

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The public is welcome to attend.