Time & Location: June 29, 2012 at 11:00 AM in HEC 356
Title: Wireless Power Transfer for Space Applications: System Design and Electromagnetic Compatibility Compliance of Radiated Emissions

Since the 1950's space exploration had captivated our imagination with extraordinary endeavors such as: first artificial satellite (1957), first animal in orbit (1957), first human in space (1961), first manned moon landing (1969), first Space Shuttle launch (1981), first spacecraft impact with a comment (2005), and so on. All the mayor space exploration accomplishments to date have something in common: the same power distribution approach from load to source (using cables and physical connections). This dissertation research evaluated the emerging Wireless Electric Power Transfer (WPT) technology and its possible implementation as a power distribution alternative for space systems. A new approach to distribute electrical power can unfold new technologies and missions to expand our capabilities for space exploration.

Due to the nature of the WPT technology operation (magnetic resonance), the greatest concern for its implementation to space systems is the electric and magnetic field intensities radiated emissions. The radiated emissions can provide a detrimental effect in the operation of the near-by sub-systems. For that reason, it was developed the Electromagnetic Compatibility (EMC) Radiated Emissions Compliance Design Evaluation Approach for Wireless Power Transfer Space Systems. This design evaluation approach consist of 5 step that provides WPT system operation insight and EMC requirement compliance predictions taking into account: (1) WPT parameter computation, (2) circuit simulation to evaluate the electrical models using the Simulation Program with Integrated Circuit Emphasis (SPICE) and Advanced Systems Design (ADS), (3) WPT electromagnetic computational analyses based on the Finite-Difference Time-Domain (FDTD) and Finite Elements Methods (FEM) numerical techniques, (4) electric and magnetic field intensity testing in accordance with the US military standard: Mil-Std-461E/F and (5) simulation and testing compliance evaluation for NASA and military standards for the use in NASA's expendable launch vehicles (rockets).

The WPT EMC design approach was successfully implemented in three WPT prototypes/magnetic elements. The three implemented WPT cases results were also successfully demonstrated with real applications by correlating the outcomes of its simulations and testing to the published requirements of actual rocket used by NASA (Atlas V, Falcon 9, Delta II, Pegasus XL and Taurus XL).

Major: Electrical Engineering

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Approved for distribution by Dr. Jiann-Shiun Yuan, Committee Chair, on April 10, 2012.

The public is welcome to attend.