Inverse Filtering Signal Localization and Identification for EMC of Electric Thrusters in a Vacuum Chamber

Alexandros Papamatthaiou and Daniel Opoka
ISAE-SUPAERO, Université de Toulouse, France

Abstract— Self-emissions in the GHz emanating from plasma thrusters remain a prevalent problem in the electromagnetic compatibility (EMC) testing between thruster and the satellite’s telecommunication antennas. Plasma thrusters can only maintain operation within a vacuum, and therefore their EMC qualification cannot be undertaken in a traditional anechoic room. This work describes a method to perform signal localization and identification within the confines of a reverberating cavity such as a vacuum chamber and performs computational tests to demonstrate functionality. Inverse filtering signal identification and localization for reverberating media utilizes experimentally acquired data on the transfer functions around a discretized volume of expected emission, and uses them to obtain information from the received signal. Sample transfer functions are obtained computationally with the use of a 2D simulation that solves the Maxwell equations of wave propagation within a chaotic environment using the Finite Difference Time Domain (FDTD) method. A single, static emitter is initialized within the map and retrieved via the use of a statistical method called correlation maximization, which is described and shown in operation. The method is robust against interference testing and demonstrates improvement with wider bandwidth as well as greater number of receiving antennas.