SPACE POWER SYMPOSIUM (C3)
Wireless Power Transmission Technologies, Experiments and Demonstrations (2)

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CONTACTLESS POWER TRANSFER SYSTEM FOR SPACE CENTRIFUGE

Abstract

In aerospace applications such as radar, centrifuge and solar power generation, it is often necessary to transfer energy across a constantly rotating interface. In common, slip rings are used to transfer power to the rotating part. However, there are some disadvantages in slip ring application, such as wear, debris production, and limited lifetime. This paper describes the design and implementation of a contactless power transfer (CPT) system, as a substitution of slip rings for rotating application.

For preliminary investigation, an analytical model of inductive link has been set up. Different configurations in terms of number of turns, wire, winding shape and compensation are discussed with respect to their impact on the system efficiency. The validity of the analytical models is confirmed with Finite Element Method (FEM) 3D simulations and the thermal model to account for the core temperature is also introduced. In addition, a 500W prototype rotating transformer is designed and constructed to validate the analytical model, based on commercially available pot cores. The consideration of the implementation of the CPT prototype is discussed in detail, and the preliminary test result is presented, in which the power transferring efficiency is up to 85

For space use, we investigate the EMC safety both to spacecraft and payloads on centrifuge and take consideration of component grading, tolerance and other reliability items. This CPT is planned on a centrifuge system, which is used for space biology and physics experiment in the future mission.