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MULTI-INTERFACE MATCHING DESIGN OF HIGH EFFICIENCY RECTENNA FOR MICROWAVE POWER TRANSMISSION SYSTEMS

Abstract

Abstract: The microwave power transmission (MPT) is regarded as the core technology of space solar power satellites, which is devoted to delivering energy to the Earth via microwave beam. Efficiency is beyond doubt the overriding concern of MPT systems. Among all segments, efficiency of rectenna is crucial to integral efficiency of microwave power transmission. To elevate the rectenna efficiency, the idea of multi-interface matching is put forward. In this paper mathematical description is presented for analysis of the rectenna efficiency. Accordingly matching principles and design methods are investigated on the power beam incident interface, the power transfer interface and the power conversion interface. On the power beam incident interface, wave impedance matching is carried out which facilitates matching between the wave impedance of the microwave power absorber surface and that of the free space. This reduces reflection by the microwave power absorber surface. On the power transfer interface, power density matching is carried out which facilitates in matching between the power density distribution across the power absorber surface and the power handling capacity of the rectifying devices. This, along with performance of the rectifying circuits, determines the size of the power absorber surface module. On the power conversion interface, impedance matching is carried out which facilitates matching between the output terminal of the power absorber cell element and the input terminal of the rectifying devices. This helps to employ optimal potentiality of the rectifying devices. A design process is developed for high efficiency rectenna based on joint multi-interface matching. Experiment is conducted with respect to some matching principles, which verify the analysis on wave impedance matching input impedance matching.