Study of an active plasma experiment module for JEM and its associated computer experiments

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In the future spacecraft and space system such as the international space station (ISS), active plasma emission is planned to be utilized in the potential control and electric thrusters. Plasma emission has great influence on spacecraft and its surrounding plasma environment because of its larger flux in comparison with ambient plasma flux. In practical use, the problem is a non-steady interference between plasma and spacecraft caused by start and stop of plasma instrument. We need to examine damage caused by charging/discharging in association with emission.

For the assessment of spacecraft with active plasma emission and its surrounding plasma environment, we will propose an experimental space platform for the JEM (Japan Experimental Module) exposed unit of ISS. In order to design the new platform, a scale-down model will be fabricated and tested in the ground facility; then its applicability to JEM will be discussed based on experimental data as well as numerical analysis using computer simulations.

In the present paper, we will briefly present the basic concept of the scale-down model for the JEM experimental platform and its associated computer experiments. As the first step, we studied the charging process of a metal body immersed in a magnetized plasma and its charge neutralization process using plasma emission by performing PIC (Particle-In-Cell) simulations. We confirmed that by plasma emission from plasma contactor the balance point of current flow into the spacecraft is changed and a floating potential of the spacecraft recover to ambient plasma potential.

We also pay attention to plasma environment and electric/magnetic environment near spacecraft. In this paper, we will report the detailed analysis of the computer experiments.