

# Study of spacecraft-plasma environment via unstructured-grid EM Particle Simulations

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Geospace environment simulator (GES) has started as one of the advanced computing research projects at the Earth Simulator Center in Japan Marine Science and Technology Center since 2002. GES project aims to reproduce fully kinetic environment around a spacecraft by using the 3-dimensional full-particle electromagnetic simulation code which could include spacecraft model inside (NuSPACE). NuSPACE can model interaction between space plasma and a space-craft by the unstructured-grid 3D plasma particle simulation code embedded in the NuSPACE. We will report current status of the project and our concept of achieving the spacecraft environment in conjunction with the space weather.

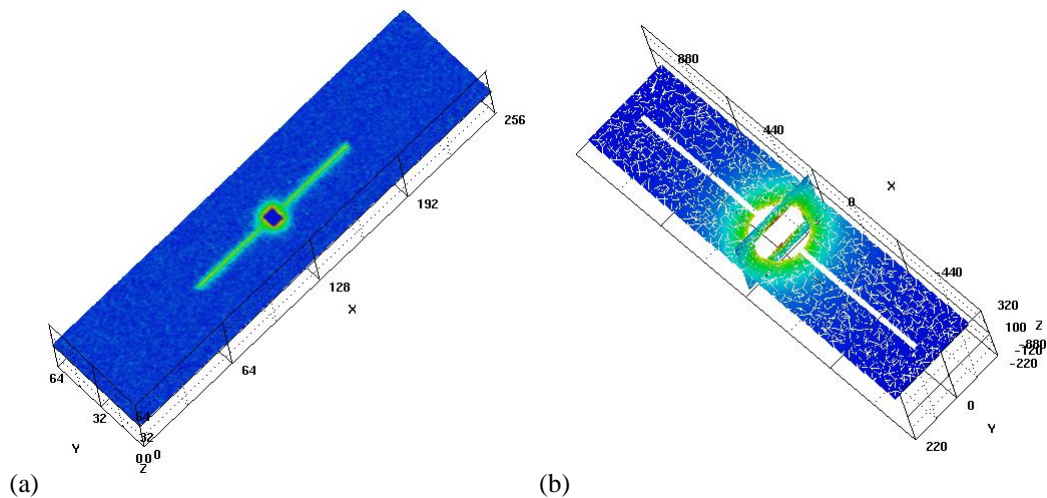


Fig. 1 Spacecraft plasma environment analysis test simulation with (a) orthogonal grid code and (b) unstructured-grid code.

Fig. 1(a) shows the electrostatic environment model around a spacecraft with a set of wire antennas. The background electrons and ions are absorbed by the spacecraft body and wire antennas. By accumulating the charge of absorbed electrons and ions, we obtain spacecraft charging and plasma sheath around the spacecraft. Fig. 1(b) shows the realistic model by using the unstructured-grid model. This model consists of 11000 nodes and 48000 tetrahedral elements. In order to embed this model into the NuSPACE, 3044 cubic elements are allocated for boundary elements. As the computational resource becomes available, the more precise model can be introduced for both engineering and physical analysis.