Development of 3D Spacecraft Charging Analysis Simulator

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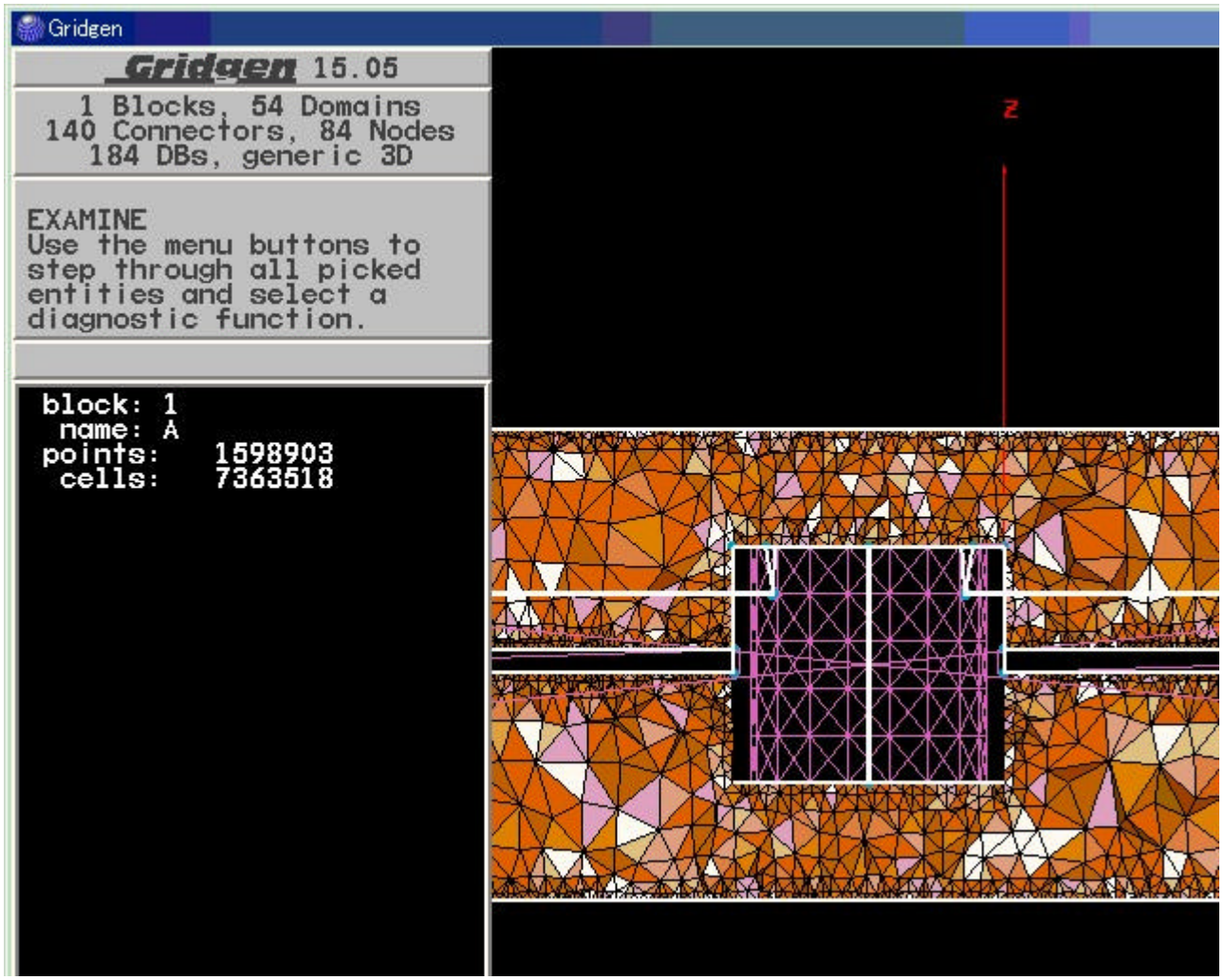
Geospace environment simulator(GES)has started as one of the advanced computing research projects at the Earth Simulator Center of Japan Agency of Marine-Earth Science and Technology since 2002.

By using this computing resource, a large scale simulation which reproduces a realistic physical model can be utilized not only for studying the geospace environment but also for researching space environment surrounding the area of human activities in space.

One of our targets is to reproduce fully kinetic environment around a satellite by using the 3-dimensional full-particle electromagnetic simulation code which includes spacecraft model inside the simulation region. Spacecraft can be modeled by the unstructured-grid 3D FPEM code. We will report current status of porting our simulation codes onto the ES and our concept of achieving the satellite environment in conjunction with the space weather.

We have developed a 3-dimensional electromagnetic particle simulation code with an unstructured-grid system. This code solves Maxwell's equations which is discretized with tetrahedral elements in 3D simulation space. Plasma particles are also traced by solving the equations of motion with the Buneman-Boris method. The main advantage of this code is the adaptability of modeling more realistic shape of a spacecraft than the orthogonal grid code. Thus, this simulation code is suitable for analyzing the plasma environment in the vicinity of a spacecraft especially in the region within a Debye length from the surface of the spacecraft as well as the spacecraft charging phenomena. We will show the scheme of this code and also show a couple of results from the test simulation runs taking into account of a realistic shape of a spacecraft.


Gridgen
Gridgen 15.05
1 Blocks, 54 Domains
140 Connectors, 84 Nodes
184 DBs, generic 3D
EXAMINE
Use the menu buttons to step through all picked entities and select a diagnostic function.
block: 1
name: A
points: 1598903
cells: 7363518
Z