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Author: Dr. Zi-long Jiao
Beijing Institute of Spacecraft Environment Engineering, China

Dr. Lixiang Jiang
Beijing institute of satellite environment engineering, China
Prof. Zizheng GONG
China Academy of Space Technology (CAST), China
Mr. Ji-peng Sun
China
Dr. Huang Jianguo
Center of Spacecraft Assembly Integration and Test, China Academy of Space Technology (CAST), China
Dr. Yunfei Zhu
China

# PARALLEL AND OCTREE-BASED ACCELERATION OF OUTGASSING CONTAMINATION SIMULATION FOR SPACECRAFT WITH COMPLEX GEOMETRIES

**Abstract**

The requirements to spacecraft such as long life, high reliability, high precision are getting more stringent, and the spacecraft uses a large number of polymer materials, such as carbon fiber/epoxy composites, thermal control coatings and adhesives. Under the space environments, mainly the vacuum, high and low temperature, the influence of the ionization irradiation environment, these polymers losed its mass and formed outgassing contamination environment. It not only affects the performance of the material itself and its products as well as the formation of the gas environment will also cause harmful effects to the spacecraft itself. So there are needs of quantitative assessment of the contamination effects. The molecular transport process is the key factors of contamination assessment, which simulates molecules emission, movement around the spacecraft and collision, and eventually deposition on the sensitive surfaces. We developed computer analysis toolkit based on the one collision theory for spacecraft molecular contamination analysis. The Monte - Carlo method, using ray represents molecules, simulates the motion process of a large number of molecules. So the transport process became a ray tracing problem. Due to the complexity of spacecraft configurations, ray tracing computation are the most time consuming, for it is extremely necessary to study the accelerating algorithm. In this paper, the octree space subdivision and parallel processing techniques was adopted to upgrade the analysis toolkit. The complex geometry of the spacecraft surface are modeled with triangular unstructured grid, the octree space subdivision technology was used to accelerate the molecular motion and surface intersection calculation, and the results showed that acceleration coefficient is proportional to n/log8 (n), up to 2 to 3 orders of magnitude. At the same time, based on shared memory multicore computing platform the OpenMP implementation of the parallel computing was used to the simulation, test showed a nearly linear speedup can be obtained.