R&D field: Engineering

Computation of compressible fluid in aircraft and spacecraft analysis

- Program name: LANS
- Developer
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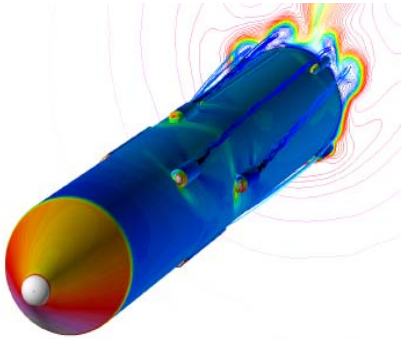
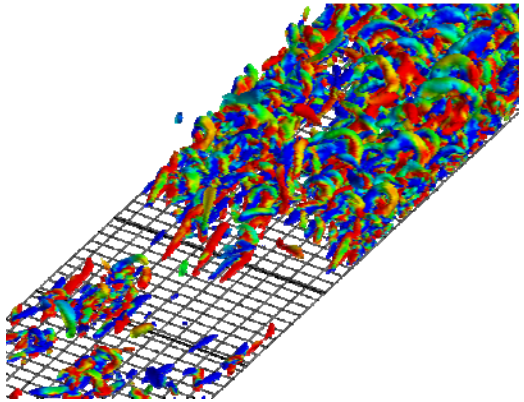
- Abstract
  - Prediction of turbulent transition around aircraft and spacecraft.
  - Study on mechanism of turbulent transition.
  - Analysis with the governing equations of compressible fluid.
- Algorithm
  - Second- and sixth-order accuracy in time and space, respectively.
  - Boundary Fitted Coordinates.
  - FORTRAN77/90.
  - Parallel computation by MPI.
- Current computation size
  - Computational grid points 150 × 100 × 200.
  - ISAS SX-6 (3 GFlops per one cpu).
  - Memory 3 GB and disk 208 GB (unsteady case).
- Future computation size in 2010
  - Computational grid points 5,000 × 5,000 × 1,000.
  - Up to about 8,000 times of the current grid points and about 8,000 times of the current computation amount.
  - Memory 24 TB and disk 1.6 PB.



Assessment analysis of rolling moment of M-V rocket



Growth of vortex structure transitioning to turbulence

- Estimated results
  - LANS can determine the turbulence transition mechanism of complicated flow around actual aerospace vehicles like interference between wing and body. It can also predict the turbulence transition quantitatively.
  - By combining the turbulence control technology based on the understanding of turbulence transition mechanism, LANS will be utilized to improve the aerodynamic performance of both the current and future aerospace vehicles, and become an indispensable design tool for innovative vehicles.
- Reference
  - http://flab.eng.isas.jaxa.jp/top.html