

## The Analysis of Arc Jet Thruster Flow Field with Chemical Equilibrium and Thermal Radiation

*J.R. Shin\*, S.J. Oh, J.Y. Choi*

*1. Department Aerospace Engineering Dpt, PNU*

*609-735 Jangjun2-Dong, Kumjung-Gu, Pusan, South korea [psk@aero.iisc.ernet.in](mailto:psk@aero.iisc.ernet.in)*

### Abstract

Arc jet thruster is a kind of the electric thermal propulsion systems. It was well known for comparatively high specific impulse thruster. Moreover, Hydrazine is used as its working fluid. Hydrazine has good properties that are low temperature decomposition and not many species at high temperature.

Navier-Stokes equations for compressible flow are used as the computation of flow field. Roe's FDS is used as spatial discretization of convection terms in governing equations. Moreover, MUSCL type variable extrapolation method is used for high order spatial accuracy and minmod limiter is used for TVD. LU-SGS is used as time integration. SST model, combined k- $\epsilon$  and k- $\omega$  turbulence model, is used as turbulence model in flow equations.

The arc model as source term in flow equations is determined by solution of electric potential field governed by an elliptic partial differential equation. Included ohm heating arc model and hydrazine chemical equilibrium are loosely coupled manner with flow equation. Algebraic radiation-conduction thermal radiation is used in flow equation for radiation effect in arc flow field.

The results of computation are compared constant specific heat capacity flow field result with other computing cases. Although the results are not included chemical rate reaction, these results give good information to design an arc jet thruster with hydrazine as monopropellant and show the performance of arc jet thruster.