1. Title

2. Research Term
   FY  2000-2002

3. Research Fields
   Microgravity Science

4. Research Categories
   ISAS Grant for Basic study oriented to utilization of space station

5. Research Theme
   Transport phenomena in an arbitrary acceleration field due to magnetizing force

6. Investigators
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7. Organization
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8. Summary of Research
   In the present research project, the model equation for magnetizing force was derived in the Navier-Stokes equation and numerically solved for various systems of transport phenomena. At first, the Rayleigh-Benard natural convection of air in a shallow vertical cylinder heated from below and cooled from above was studied numerically and experimentally afterwards. These data agree each other and can be correlated well with the magnetic Rayleigh number proposed by Braithwaite et al. This was published in Journal of Heat Transfer, ASME recently. Then we studied the application of strong magnetic field for the pipe heated partially to drive the air which was discovered by Uetake et al. We developed a new computer code with pressure boundary condition at the inlet and outlet for this problem since we do not know a priori the enhancement amount of volume flow rate. This successfully gave converged solution to indicate the enhancement both in the volume flow rate and heat transfer rate. The enhancement of heat transfer rate was confirmed in comparison with the classical Graetz solution. We then carried out numerical computations for air in an enclosed cylinder with an electric coil placed around the cylinder to produce a magnetic field inside the cylinder. The upper 1/3 and lower 1/3 of the side wall were heated and cooled respectively with thermally insulated for 1/3 wall in-between. Depending on the level of the coil from the bottom of a cylinder, the convection modes were either downward or upward in the center. These characteristics can be employed for enhancement of heat transfer rate even in a micro gravity field.

   These model and computational scheme would be employed for various possible applications in the near future.

9. Publication List
      S. Maki, T. Tagawa and H. Ozoe

   2. The inducement of airflow in a vertical cylindrical container with the stagnant conduction state by the magnetizing force.
3. Numerical analysis of air convection in a vertical cylinder supported by strong magnetic field. 
   P. Filar, M. Kaneda, T. Tagawa, H. Ozoe and J.S. Szmyd

4. Enhancement of heat transfer and air flow rates in a pipe with an application of a magnetic field. 
   S.S. Lu, C.H. Lee, T. Tagawa, H. Ozoe and B. Hua

   Int. J. Heat Mass Transfer (in press) 
   T. Tagawa, A. Ujihara and H. Ozoe

10. URL