Numerical Study of Compressible Boundary-Layer Transition between Two Concentric Cylinders

NASA Lewis Research Center
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Final Report for the Period
April 15, 1990 - October 31, 1993

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The period of support of this Cooperative Agreement was from April 15, 1990 to October 31, 1992, with a no-cost extension to October 31, 1993 to complete some unfinished tasks.

Within this period, research associate Dr. Kai-Hsiung Kao has made tremendous contributions to this project and has produced an impressive amount of publications. At the early stage of the research, he spent some time on the extension of his doctoral thesis in a subject closely related to the present project. His major research effort was devoted to the investigation of stability of a viscous flow between two differentially rotating cylinders, with an emphasis on the effects of compressibility and heat transfer. Actually, the research topics were not restricted to those described by the title of this Agreement, as reflected in some of the more recent publications.

Results of this sponsored research are represented by the following list of publications, which are arranged in chronological order:

"Stability of the Boundary Layer on a Spinning Semi-Infinite Circular Cylinder"; K.H. Kao and C.Y. Chow; Journal of Spacecraft and Rockets, Vol. 28, No. 3, May-June 1991, pp. 284-291.

"Stability of the Boundary Layer on a Spinning Blunt-Nosed Cylinder"; K.H. Kao and C.Y. Chow; Journal of Spacecraft and Rockets, Vol. 28, No. 3, May-June 1991, pp. 299-305.

"Stability of Compressible Taylor-Couette Flow"; K.H. Kao and C.Y. Chow; AIAA Paper 91-1642, AIAA 22nd Fluid Dynamics, Plasma Dynamics & Laser Conference, June 24-26, 1991.

"Stability of Compressible Taylor-Couette Flow," presented at NASA Computational Fluid Dynamics Conference, NASA Ames Research Center, Moffett Field, CA, March 12-14, 1991; published later in Computational Fluid Dynamics, NASA CP-10078, 1992, pp. 193-203.

"Linear Stability of Compressible Taylor-Couette Flow"; K.H. Kao and C.Y. Chow; Physics of Fluids A, Vol. 4, No. 5, May 1992, pp. 984-996.

"Numerical Investigation of Compressible Taylor-Couette Flow for a Wide Gap"; K.H. Kao, C.Y. Chow and M.S. Liou; presented at International Conference on Fluid Mechanics and Theoretical Physics, June 1-3, 1992, Beijing, China. Submitted to Physics of Fluids A for publication.

"Grid Adaptation Using Chimera Composite Overlapping Meshes"; K.H. Kao, M.S. Liou and C.Y. Chow; AIAA Paper 93-3389, AIAA 11th Computational Fluid Dynamics Conference, July 6-9, 1993. Also NASA TM-106163, 1993. Accepted for publication in AIAA Journal.