



FMRC Fluid Mechanics Research Seminar Series

All Speed CFD Schemes

SHIMA, Eiji

JAXA (Japan Aerospace Exploration Agency),
Engineering Digital Innovation Center, JAPAN

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İTÜ Uçak ve Uzay Bilimleri Fakültesi, TAV Konferans Salonu

Abstract: For about 10 years, we have been studying all speed Riemann flux function that can calculate low Mach number flow without parameter adjustment in a compressible CFD scheme. The typical scheme, Simple Low Dissipation Advection Upstream Splitting Method (SLAU), has been widely used because it can calculate a wide range of flow fields from low Mach number to supersonic speed with high accuracy.

On the other hand, the time derivative preprocessing method is known to be effective for efficient time integration at low Mach numbers, but it is difficult to adjust the parameter called cutoff Mach number.

At this talk, the formulation of a new all-speed compressible CFD scheme, which unifies a compressible CFD schemes of implicit MUSCL (Monotonic Upstream-Centered Scheme for Conservation Laws) and an incompressible CFD scheme of SMAC (Simplified Marker and Cell) methods, SMUC (SMAC-inspired Mach Uniform Compressible scheme), is presented. New scheme has no Mach dependent adjustable parameter. Numerical examples show improvements by this scheme, such as several times speed up to the convergence in low Mach number range. It is also shown that the procedure of SMAC method is theoretically derived from the operator factorization of minimum errors.

Biography: Director of JAXA's Engineering Digital Innovation Center & Senior Researcher, 2007 to present. He was an aerodynamic engineer at Kawasaki Heavy Industries from 1985 to 2007. He received his PhD degree from Kobe University.

Dr. Shima leads and manages JAXA's Engineering Digital Innovation Center, as well as carries out research on basic numerical algorithms for Computational Fluid Dynamics.

