

Title: Numerical Solution of the Three-dimensional Compressible Flow

Author: Martin Kyncl

Department: Department of Numerical Mathematics

Supervisor: Doc. RNDr. Jiří Felcman, CSc.

Abstract: This thesis deals with a fluid flow in 3D in general. The system of the equations, describing the compressible gas flow, is solved numerically, with the aid of the finite volume method. The main purpose is to describe particular boundary conditions, based on the analysis of the incomplete Riemann problem. The analysis of the original initial-value problem shows, that the right hand-side initial condition, forming the Riemann problem, can be partially replaced by the suitable complementary condition. Several modifications of the Riemann problem are introduced and analyzed, as an original result of this work. Algorithms to solve such problems were implemented and used in code for the solution of the compressible gas flow. Numerical experiments documenting the suggested methods are performed.

Keywords: compressible fluid flow, the Navier-Stokes equations, the Euler equations, boundary conditions, finite volume method, the Riemann problem, numerical flux, turbulent flow