A Second-Order Finite-Difference Method for Compressible Fluids in Domains with Moving Boundaries

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In this talk, I will describe how to construct a finite-difference shock-capturing method for the numerical solution of the Euler equation of gas dynamics on arbitrary two-dimensional domain, possibly with moving boundary. The boundaries of the domain are assumed to be changing due to the movement of solid objects/obstacles/walls. The method is based on discretizing the equation on a regular Cartesian grid in a rectangular domain, which contains the original domain. We identify inner and ghost points. The inner points are the grid points located inside the original domain, while the ghost points are the grid points that are outside this domain but have at least one neighbor inside. The evolution equations for inner points data are obtained from the dis-cretization of the governing equation, while the data at the ghost points are obtained by a suitable extrapolation of the primitive variables (density, velocities and pressure). Particular care is devoted to a proper description of the boundary conditions for both fixed and time dependent domains. Several numerical experiments are conducted to illustrate the validity of the method. We demonstrate that the second order of accuracy is numerically assessed on genuinely two-dimensional problems.