THE COMPRESSIBLE NAVIER-STOKES EQUATIONS ON A POLYGON: CORNER SINGULARITIES AND REGULARITIES

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Many issues in partial differential equations are involved in resolving singularities which are caused by singular boundaries of the solution domain and are to describe their intrinsic properties. Likewise, the Navier-Stokes equations for incompressible or compressible flows also confront with such problems.

In this talk I will discuss about the evolution compressible Navier-Stokes system on polygonal domains. It is shown that the lowest order of the corner singularity of the system is the same as that of the heat equation. In a suitable Banach space the velocity is split into singular and regular parts and the coefficient of the singularity is expressed by convolution of some two functions in the time variable. By a formula of the pressure we observe propagation of the corner singularity along the characteristic lines emanating from the corners and also unboundedness of derivatives of pressure there. An increased regularity for the remainder part is established.

The information for singularities may have physical applications. In particular, the compressibility is a dominant factor in high speed flows. The flows may change drastically around the corners or edges: imagine airplane wing or flows in a L-shape type channel. So more rigorous analysis of solution is needed on such regions.

In addition, it can be used in overcoming the polluting effect of the corners on the finite element method and in case that an increased regularity for the solution is established by sorting out the singularities, it may be used in determining an accurate and better rate of convergence of the finite element solution. So a complete mathematical analysis for corner singularities and regularities of solutions is needed.

REFERENCES


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