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The influence of the pressure gradient on the development of Görtler vortices JOSUEL ROGENSKI, LEANDRO F. DE SOUZA, Universidade de São Paulo, Brasil, JERZY M. FLORYAN, University of Western Ontario —
The optimization in the process of turbomachinary design demands the ability to predict the transition region. The flow over the concave part of a turbine blade is subjected to centrifugal instability and pressure gradient where streamwise vortices can be formed. These vortices cause strong distortions in the streamwise velocity profile. In this sense, a study of the pressure gradient effect focused on the Görtler vortices development is necessary. The Navier-Stokes equations in the vorticity-velocity formulation are used. It is assumed periodicity in the spanwise direction. A mesh stretching in the normal direction is adopted. The use of Direct Numerical Simulation is necessary to ensure that all relevant scales are correctly be represented. Compact high-order finite difference approximations are adopted in the streamwise and wall normal directions. The temporal advance is done by the classical 4th order Runge-Kutta method. The elliptic problem is solved by the use of a multigrid method. The code is parallelized using a domain decomposition technique. The results indicate that the numerical code is able to simulate the physical phenomena under investigation. The presence of a favorable pressure gradient tends to stabilize the flow.

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