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Numerical Error Evaluation for Tip Clearance Flow Calculations in Centrifugal Compressor

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This paper focuses on the evaluation of numerical errors due to grid resolution. Since rigorous numerical error assessment requires important computational resources, an attempt is made to obtain a numerical solution which is locally mesh independent. The proposed method is applied to the tip clearance flow region of a centrifugal compressor solution obtained with a the commercial RANS code Fine/Turbo. First, the design of experiment method is used to identify mesh parameters having a dominant influence on the tip clearance flow. The results ensure that refining the computational grid only in the tip region is sufficient to obtain a “local benchmark”. The computed solutions on the refined grids then show a qualitative convergence of the shroud friction coefficient. Then, the different solutions allow a numerical error evaluation for the friction coefficient on the shroud surface. Thus, the main advantage of the proposed method is an affordable way to define local mesh requirements, that will still have to be fulfilled when global independence is the concern.

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