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COMPUTATIONS OF STRESSED-STRAINED STATE OF COMPRESSOR RIM BLADE USING OPENFOAM NUMERICAL SIMULATION PLATFORM

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The now design of compressor rims requires a computational verification of strength characteristics using the CAE systems such as ANSYS, NASTRAN, etc. Those computations do not abolish field tests, however, they significantly increase the probability of satisfactory tests; due to the reduction of tests, costs and time for fine-tuning are drastically cut. Similarly to strength computations, three-dimensional gas-dynamic ones play the role of full-scale tests to finalize the design to the required parameters. Nevertheless, today's tools for solving those problems are mainly presented by commercial high-priced packaged programs. Also, it does not always happen that they reveal models and algorithms incorporated. Thus, the results obtained are suspect for the designer. In addition, the simultaneous solution of the above-mentioned problems is of considerable scientific and practical interest, resulting in significant design time cutting and the improved design efficiency. On this basis, the development of scientific and methodic support for designing the compressor rim blades strength is topical. The scientific and methodic support has been developed to solve simultaneously the problem of a numerical simulation of spatial turbulent gas flows through compressor rims and the problem of the computation of the strength of the compressor rim blades. This software has been developed using solvers of the OpenFOAM library to compute the flow field in the vane channel and a stressed-strained state of the blade. Solvers interact via the data communication under boundary conditions. It is assumed that the change in the shape of the blade under the influence of the gas flow can be neglected. The developed scientific and methodic support has been tested solving the problem of interactions between the clamped beam and its streamlined flow. The results obtained agree satisfactorily with the results of the solution of this problem using the standard icoFSIFoam solver, which is part of the branch of the OpenFOAM extensions. The flow field in the vane channel of the axial compressor rim and the stressed-strained state of its blade have been computed. A qualitative analysis of the obtained results demonstrates the applicability of the developed scientific and methodic support. In the future, additional studies are assumed to conduct for evaluating its efficiency and applicability with the use of the corresponding experimental data.

Keywords: *compressor rim, compressor rim blade, numerical simulation, stressed-strained state, FSI problem, Open FOAM, Navier-Stokes equations, von Mises stress.*

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