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三维环境下离心/斜流压气机二维叶型优化设计

Optimization design of centrifugal/oblique flow compressor two-dimensional blade profiles in three-dimensional environment

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中文摘要:

考虑离心/斜流压气机转子叶片通道内流动的强三维性,提出在三维环境下进行二维叶型优化设计.通过对能量方程中黏性耗散项改进,解决了Denton黏性体积力方法模拟离心/斜流叶轮三维流场效率偏高的不足.将改进流场计算模块与并行遗传算法寻优模块相结合,构成离心/斜流压气机二维叶型优化设计软件.采用所研制的软件,分别对离心叶轮和斜流叶轮叶尖处叶型进行优化设计.优化叶片基本达到目标流量和压比,在整个工作范围内效率都提高明显:在设计点离心叶轮效率由0.938提高到0.947,斜流叶轮效率由0.899提高到0.918.

英文摘要:

As for strong three-dimensional flow in centrifugal/oblique flow compressor rotor blade passages, the two-dimensional blade profiles were optimally designed in three-dimensional environment. The efficiency of centrifugal/oblique flow compressor calculated by the Denton viscous volume force method was obviously higher, and the problem was solved by modifying the viscous dissipation in the energy equation. Then, optimization design software of two-dimensional blade profiles was built by combining the modified flow field calculation module with the parallel genetic algorithm. The software was used for designing tip profiles of centrifugal impeller and oblique flow impeller. The mass flow and pressure ratio of these two optimized impellers are very close to objective values, and the efficiency in whole working range is significantly improved. At the design point, the efficiency of centrifugal impeller is improved from 0.938 to 0.947, and the efficiency of oblique flow impeller is improved from 0.899 to 0.918.

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