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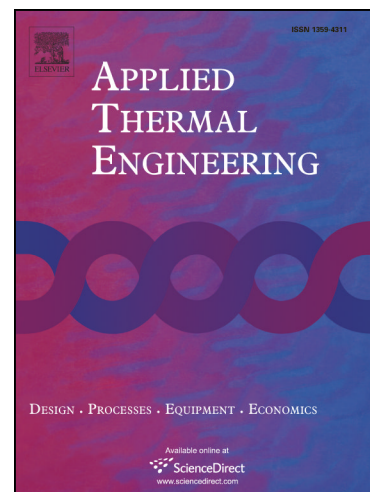
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# Design and performance analysis of three stage centrifugal turbine

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## HIGHLIGHTS

- 1D design procedure of centrifugal turbine was introduced
- The simulated total-static efficiency of three stage turbine reaches 91.26%
- Off-design performance of three stage turbine was analyzed
- The performances of designed turbine and original axial flow turbine was compared

## ABSTRACT

In this paper, the three-stage centrifugal turbine was designed based on the thermodynamic parameters of a four-stage test axial turbine. 1D aerodynamic design, 3D numerical simulation and optimization, and analysis on off-design performance of the centrifugal turbine were conducted. The results show that the key simulation parameters including total-static efficiency, shaft power, reaction degree, velocity ratio and pressure ratio of turbine stages are close to the 1D calculation values; at the design condition, streamline is smooth in the passage of turbine cascades; high efficiency has been obtained, indicating that the aerodynamic performance of three-stage centrifugal turbine meets the designed requirements. In off-design condition, the total-static efficiency of the designed turbine increases with the increase of pressure ratio first and then decreases; the shaft power decreases with the increase of pressure ratio; the mass flow rate increases gradually with the

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