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Numerical Study of Off-Design Performance of a Highly Loaded Low Pressure Turbine Cascade

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Abstract : The flow field passing through a highly loaded low pressure (LP) turbine cascade is numerically investigated at design and off-design conditions. The Field Operation And Manipulation (OpenFOAM) platform is used as the computational Fluid Dynamics (CFD) tool. Firstly, the influences of grid resolution on the results of k-ε, k-ω, and LES turbulence models are investigated and compared with those of experimental measurements. A numerical pressure under-shoot is appeared near the end of blade pressure surface which is sensitive to grid resolution and flow turbulence modeling. The LES model is able to resolve separation on a coarse and fine grid resolutions. Secondly, the off-design flow condition is modeled by negative and positive inflow incidence angles. The numerical experiments show that a separation bubble generated on blade pressure side is predicted by LES. The total pressure drop is also been calculated at incidence angle between -20◦ and +8◦. The minimum total pressure drop is obtained by k-ω and LES at the design point.

Keywords : low pressure turbine, off-design performance, openFOAM, turbulence modeling, flow separation
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