

Modelling unstable operation of compressors

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Summary:

The present study deals with the Integrated Gasification Combined Cycle from a thermodynamics and fluid dynamics point of view.

The paper focuses on the potential risk of fatigue failure of the stator row vanes of an axial compressor in a power plant where low caloric syngas is used as fuel. Dynamically dangerous phenomena can be caused by flow pulsations that were found by numerical as well as experimental investigation of the gas turbine operation. The mechanism of flow unsteadiness was studied using CFD results.

Vortex structures from the cascade at positive incidence angles are responsible for the origin of flow pulsation. The interaction of blade rows plays an important role.

Numerical study of unsteady flow in the cascades of the last compressor stage was carried out by the application of the CFD SW FLUENT ANSYS.

Mathematical model is based on the system of Navier-Stokes equations for the turbulent flow of compressible fluid.

For the turbulence model, the 7-equations Reynolds stress model is adopted. Non-equilibrium wall functions defined in the FLUENT code are used to model the flow near the blade profiles. The numerical model is solved using the Runge-Kutta method in the form of finite volumes.

Coupled implicit scheme with second order accuracy and default under relaxation factors was applied.