Faculty Engineering Technology
Program Mechanical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: Engineering Fluid Dynamics

As part of his MSc thesis assignment

K. Stoutmeijer

will give a presentation, entitled:

Flow Characteristics in the STC-ECO Compressor
Simulation of the Flow around the Mid Span Radial Stop

Date: Friday June 24, 2016
Time: 10:00
Room: Horst Building Room N-109

Summery
The STC-ECO is a new type of compressor developed by Siemens Hengelo. The main advantage of this compressor type is that the electro motor and the compressor section share a single casing. This eliminates the use of dry gas seals, enhances the reliability and reduces maintenance, making the STC-ECO potentially suitable for subsea applications.

During operation of the STC-ECO, heat is generated in the magnetic bearings and the clearance between the rotor and the stator due to the high rotational speeds which range up to 10.000 rpm. After the 1st compression stage a part of the process flow is extracted and used as a cool flow for the rotor stator gaps and the bearings. This cooling flow contributes to the overall losses and should therefore be minimized without compromising machine integrity.

The Mid Span Radial Stop (MSRS) is positioned concentric to the shaft, with a close clearance gap of 0.8 mm. The primary function of the MSRS is to guide the cooling flow back into the main flow. The second function is to disable excessive radial shaft movement. Inspection of a STC-ECO compressor which has been in operation raised the suspicion that the flow around the MSRS is not as designed. There are indications that a flow recirculation occurs around the MSRS, which may lead to insufficient cooling and a potential severe heat buildup in the clearance between the MSRS and the shaft.

In this thesis the flow around the MSRS is investigated by means of numerical methods. Using ANSYS-CFX a numerical model is built from which the flow field is solved. The model has been validated using the experimental results of the Taylor Couette Turbulence. Subsequently the flow in the MSRS design has been investigated. The results show that indeed in the current design a recirculation occurs around the MSRS with a magnitude depending on the rotational speed, the suction pressure and the cool flow rate. The simulations also provide valuable insight on the frictional losses and heating. As a result of the study the cooling efficiency can be increased by an improved the MSRS design.

Assessment committee:
Prof.dr.ir. C.H. Venner (chairman, mentor)
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d.d. 25/05/2016