Faculty Engineering Technology
Program Mechanical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

Peter Puttkammer

will give a presentation, entitled:

Theory and application of an analytical approach for the determination of the transmission of sound waves through a stator

Date: Friday November 13, 2015

Time: 14:00

Room: **Horst Building Room N109**

Summary:

The main objective of turbomachines is to transfer energy between the rotating impeller blades and the working fluid, which is achieved by increasing or decreasing the fluid velocity and/or the pressure. Stator rows are applied to redirect the flow of the fluid in order to construct an efficient turbomachine. Due to the interaction of the moving fluid with the blades of blade rows (rotors and stators), disturbances in the flow are generated. One of the downsides of these disturbances is that these can be experienced as sound waves, which can be a source of annoyance for communities.

The generation and propagation of sound in turbomachines – such as airplane engines, turbines, compressors, etc. – is a topic studied at the German Aerospace Lab (*Deutsches Zentrum für Luft- und Raumfahrt*, DLR). The present master thesis is part of the DLR-project entitled *Transmission and Reflection of Blade Rows*. In this master thesis the theory and application of the two-dimensional blade row model of Smith [*Aeronautical Research Council Reports and Memoranda*, 1972] for a stator are investigated.

The present study is divided in three parts. In the first part the governing equations and its applications for two-dimensional plane sound waves are studied. Important characteristics of sound waves are obtained, which are needed for the investigation of blade row models. The second part of the study focuses on the construction of singularity distributions, applied in blade row models in order to satisfy the impermeability conditions at the blade surfaces. The main focus lies on the implemented blade row model of Smith. The third part discusses the results of the 2D blade row model applied in 2D and 3D situations. The 2D results are compared with various other 2D models, whereas the 3D results are compared with results of the CFD code Lin3D provided by the MTU Aero Engines, a German aircraft engine manufacturer.

Assessment committee: **Chairman,**

Prof.dr.ir. C.H. Venner (chairman)
dr.ir. R. Hagmeijer (mentor – University of Twente)
dr.ir. U. Tapken (mentor – DLR)
dr.ir. Y.H. Wijnant (external member)

d.d. _____