Faculty Engineering Technology Program
Mechanical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

Niels Leijtens

will give a presentation, entitled:

Optimal Buffer Design for the Symphony Wave Power System

Date: 21 Oct. 2016
Time: 14:00
Room: HT700B

Summary:
Renewable energy is a hot topic these days. Wind farms are popping up all over the world and more and more solar panels start to produce electricity. Why are we not producing energy from the sea? It is proved that the ocean could be a powerful energy source. The main problem with this is the diversity in wave heights. Most wave heights are low and easy to use for energy extraction, while a few times the ocean is rough and sea waves can become 3 times as high.

The Symphony is a wave power system which generates power from sea waves by an oscillating floater. This motion pumps water through a turbine. The main goal of the present research is to design the most optimal buffer system which controls mechanically the motion of the Symphony. A optimal buffer design is defined by optimal energy extraction in calm weather conditions while the motion is controlled during rough weather conditions.

The natural frequency of the system is designed such that it is close to the most probable wave frequency. By oscillating around the equilibrium position at the natural frequency an optimal power output is generated. It is shown that by adding a negative spring to a positive spring the combined spring has a low natural frequency and high bandwidth which is ideal for a wave power system such as the Symphony.

The optimal spring design for the Symphony has a larger spring force on both ends for control of high sea waves, while in the mid-section a tuned linear spring is present, which is ideal for low sea waves that have the highest probability. In between an S-curve is made to make the geometry more smooth. Together with the control system it restricts the floater motion within an allowable range for 95% of the weather conditions and optimally extracts energy in calm sea states.

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