DEPARTMENT OF ENERGY TECHNOLOGY
AALBORG UNIVERSITY

# PhD Public Defence

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| **Title:** | Modelling and Analysis of Seawater Scrubbers for Reducing SOx Emissions from Marine Engines |
| **Location**: | Pontoppidanstræde 111, auditorium |
| **Time**: | Friday 15 February at 13.00 |
| **PhD defendant**: | Anders Schou Simonsen |
| **Supervisor:** | Associate Professor Kim Sørensen |
| **Moderator:** | To be announced later |
| **Opponents**: | Associate Professor Samuel Simon Araya, Dept. of Energy Technology, Aalborg University (Chairman)<br>Professor Dr.-Ing. Milovan Perić, Founder and general manager of CoMeT Continuum Mechanics Technologies, Germany<br>Professor Dr. Hans Kuerten, Eindhoven University, The Netherlands |

**All are welcome. The defence will be in English.**

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**Abstract:**

The aim of this thesis is to develop an accurate computational model of a seawater scrubber for reducing SOx emissions from marine engines. The motivation for developing this model is to optimize the scrubber design to be more energy efficient and to investigate the phenomena governing seawater scrubbers.

The proposed model takes both the continuous phase, the liquid phase, and the liquid wall films flowing down the scrubber shell into account. The chemistry governing SOx absorption in seawater is modelled as well, where 17 species are considered in the liquid phase. MATLAB and OpenFOAM are used to resolve the liquid and continuous phases respectively, where the two software packages exchange information during simulation in order to couple the phases. This multi-disciplinary model combines numerous sub-models, where several model parameters are unknown. Therefore, the model was tuned to match results from experimental tests, which were carried out at the Alfa Laval Test & Training Centre.

The tuned scrubber model was capable of predicting the outlet temperature, sulfur concentration, and overall pressure loss with an average accuracy of plus/minus 1.8 K, 10.1 ppm (v/v), and 57.5 Pa respectively. The accuracies fluctuated for each test carried out, where the RMS-errors were 3.1 K, 20.4 ppm (v/v), and 77.3 Pa, which corresponds to relative deviations compared to the experimental tests of approximately 11.5 %. This Ph.D. project has contributed to a better understanding of seawater scrubbers and the modelling of these, which allows for developing more efficient scrubbers, which will reduce energy requirements.