MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

DEPARTMENT OF CONSTRUCTION SCIENCES | FACULTY OF ENGINEERING LTH | LUND UNIVERSITY

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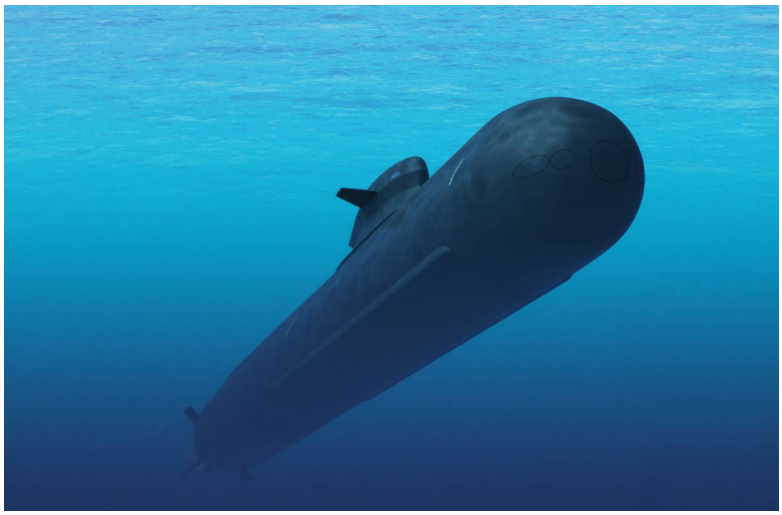
FE-ANALYSIS OF FLUID-STRUCTURE INTERACTION



BACKGROUND

Equipment mounted on the hull on the outside of a submarine may be subjected to shock loading from different types of explosions. An underwater explosion will produce several shockwaves and will thus make the equipment vibrate. To accurately model the oscillations of the equipment, it is important to capture the fluid-structure interaction between the equipment and the surrounding fluid. Such models already exist and are based on the finite element method. However, the existing models have not been sufficiently validated with respect to experimental data. A better understanding of the limitations of current models will help improve the design of the mounted equipment and may be used to develop the next generation of submarines.

OBJECTIVE AND METHOD

In order to validate current models, a deep understanding of the concept of fluid-structure interaction first has to be gained. This is done by studies of the theory behind current models. Numerical analysis will then be performed in the software LS-DYNA for a case where a box is oscillating in water. Simultaneous to the simulations, experiments of the same case will also be conducted in order to validate the numerical methods.

The analysis will be focused on the natural frequencies of the vibrations and the concept of added mass. In LS-DYNA, an Eulerian mesh will be used and the fluid will be modelled using the material model MAT_ACOUSTIC. The solver will be explicit. An important aspect of the project is to validate said material model. The objective is to gain a better understanding of the limitations and possibilities of numerical methods in LS-DYNA for problems with fluid-structure interaction.

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