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Wave Run-Up on Offshore Wind Turbines

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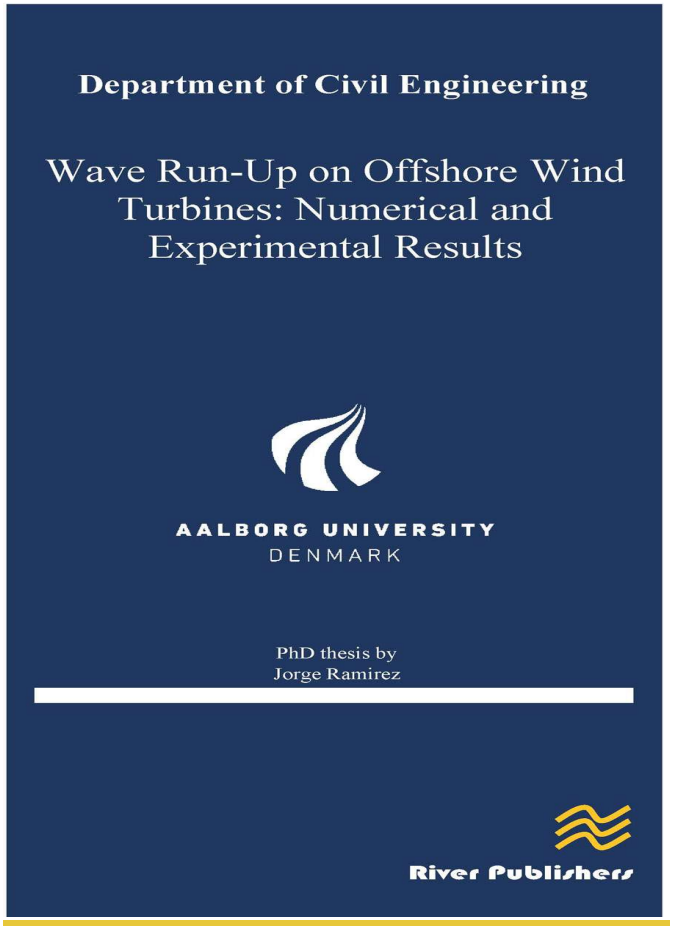
This study has investigated the interaction of water waves with a circular structure known as wave run-up phenomenon. This run-up phenomenon has been simulated by the use of computational fluid dynamic models.

The numerical model (NS3) used in this study has been verified rigorously against a number of cases. Regular and freak waves have been generated in a numerical wave tank with agentle slope in order to address the study of the wave run-up on a circular cylinder. From the computational side it can be said that it is inexpensive. Furthermore, the comparison of the current numerical model presented in this thesis with the measured results from the experiments has shown a good agreement.

Besides this numerical study, model scale experiments have been conducted where the wave run-up on a slender circular cylinder in irregular sea state was measured with surface gauges located close to the cylinder. Based on appropriate analysis the collected data has been analysed with the stream function theory to obtain the relevant parameters for the use of the predicted wave run-up formula. An analytical approach has been pursued and solved for individual waves. Maximum run-up and 2% run-up were studied to get a better understanding of the phenomenon. According to the results from this analysis it has been established that the run-up heights are largely influenced by the deep water wave steepness. Overall, the outcome of this research is that the simplified model presented in this thesis of the wave run-up on a slender circular cylinder is the most useful tool for platform designers.



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