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Abstract: In these years there is an increased focus on renewable energy. In Denmark there is a particular focus on offshore wind turbines because they do not generate a surrounding population. There are great expectations for the development of offshore wind turbines foundations, as the foundations represent one third of the total cost of an offshore wind farm. A Bucket foundation is an innovative type of foundation that is still under development. The advantage of this type of foundation is a reasonably simple installation and the possibility of closure. Traditional offshore wind turbine is made of steel or reinforced concrete with an extensive welding and assembly process which is both inconvenient and expensive workflow. Therefore it is desirable to find a material that provides a cheaper and easier production without compromising the foundation strength and stiffness.

Detailed standards and norms are established for offshore constructions made of steel. As an alternative to steel, a composite structure made of comparatively thin steel sheets and high-tension concrete—compact reinforced composite (CRC). In this research study will examine whether this composite material may be used to make bucket foundations, and whether it would be economically advantageous. Currently, the application of high-tension concrete includes the reconstruction of steel bridges and joining the tower and foundation of offshore wind-turbine structures. The lack of standards and norms in the field of composite steel and concrete structures makes the application of shell elements quite limited.

Attachment between the layers in the composite shell structure is the central area of focus of this project. The steel and concrete are glued together so that the material has good material properties when exposed to tension and compression as well as bending. A thorough analysis of structures built by the proposed steel–concrete composite shells demands the application of computational models. In this project a finite-element (FE) model will be developed in Abaqus and calibrated by experimental testing. A comparison will be made with a model based on the assumption of perfect bonding between the two materials. To characterize both tension and compression in the concrete, a plastic damage model is used in this study.

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