# Structural evaluation of offshore wind turbines supported on a jacket using Artificial Neural Networks

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## ABSTRACT

Reducing the cost of the support structure of offshore wind turbines is an important objective to promote the development of this technology. In the design stage, the aim is to obtain a structure that verifies the different technical requirements imposed by the regulations and minimizes the amount of material used. In the literature, there are authors who manage to obtain efficient designs by approaching the process as an optimization problem for specific configurations (e.g. [1, 2]). However, introducing structural calculation and verification in an iterative process, such as optimization, considerably increases the computational cost of this process. For this reason, a surrogate model based on Artificial Neural Networks (ANN) is proposed to predict whether a jacket support structure would verify the technical requirements based on the characteristics of the wind turbine and the site.

A dataset is generated to train the ANN. These synthetic data collect the characteristics of the OWT-jacket-foundation system and the site; as well as the result of the technical checks, obtained by means of a finite element structural model. Analysing the confusion matrix of the test data, it is observed that this type of tool allows to establish the technical feasibility of a jacket support structure in a sufficiently precise way. Thus, the computational costs in the pre-design stage can be reduced through the use of Machine Learning techniques, such as ANNs.

## REFERENCES

[1] K. Sandal, A. Verbart, and M. Stolpe. Conceptual jacket design by structural optimization. *Wind Energy*, 21(12):1423–1434, 2018.

[2] I. Couceiro, J. París, F. Navarrina, R. Guizán, and I. Colominas. Optimization of Offshore Steel Jackets: Review and Proposal of a New Formulation for Time-Dependent Constraints. *Archives of Computational Methods in Engineering*, pages 1–20, 2019.