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Interactive comment on "A fully integrated optimization framework for designing a complex geometry offshore wind turbine spar-type floating support structure" *by* Mareike Leimeister et al.

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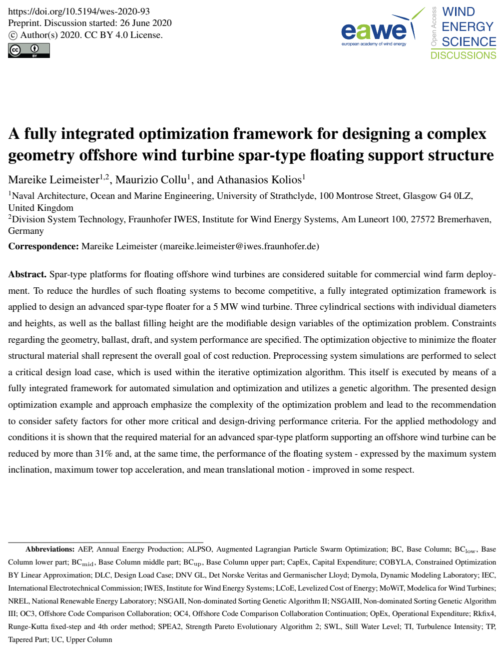

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A fully integrated optimization framework for designing a complex geometry offshore wind turbine spar-type floating support structure

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Abstract. Spar-type platforms for floating offshore wind turbines are considered suitable for commercial wind farm deployment. To reduce the hurdles of such floating systems to become competitive, a fully integrated optimization framework is applied to design an advanced spar-type floater for a 5 MW wind turbine. Three cylindrical sections with individual diameters and heights, as well as the ballast filling height are the modifiable design variables of the optimization problem. Constraints regarding the geometry, ballast, draft, and system performance are specified. The optimization objective to minimize the floater structural material shall represent the overall goal of cost reduction. Preprocessing system simulations are performed to select a critical design load case, which is used within the iterative optimization algorithm. This itself is executed by means of a fully integrated framework for automated simulation and optimization and utilizes a genetic algorithm. The presented design optimization example and approach emphasize the complexity of the optimization problem and lead to the recommendation to consider safety factors for other more critical and design-driving performance criteria. For the applied methodology and conditions it is shown that the required material for an advanced spar-type platform supporting an offshore wind turbine can be reduced by more than 31% and, at the same time, the performance of the floating system - expressed by the maximum system inclination, maximum tower top acceleration, and mean translational motion - improved in some respect.

Abbreviations: AEP, Annual Energy Production; ALPSO, Augmented Lagrangian Particle Swarm Optimization; BC, Base Column; BC_{low}, Base Column lower part; BC_{mid}, Base Column middle part; BC_{up}, Base Column upper part; CapEx, Capital Expenditure; COBYLA, Constrained Optimization BY Linear Approximation; DLC, Design Load Case; DNV GL, Det Norske Veritas and Germanischer Lloyd; Dymola, Dynamic Modeling Laboratory; IEC, International Electrotechnical Commission; IWES, Institute for Wind Energy Systems; LCoE, Levelized Cost of Energy; MoWiT, Modelica for Wind Turbines; NREL, National Renewable Energy Laboratory; NSGAII, Non-dominated Sorting Genetic Algorithm II; NSGAIII, Non-dominated Sorting Genetic Algorithm III; OC3, Offshore Code Comparison Collaboration; OC4, Offshore Code Comparison Collaboration Continuation; OpEx, Operational Expenditure; Rkfix4, Runge-Kutta fixed-step and 4th order method; SPEA2, Strength Pareto Evolutionary Algorithm 2; SWL, Still Water Level; TI, Turbulence Intensity; TP, Tapered Part; UC, Upper Column

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Fig. 1.