Abstract of the thesis entitled:

Static and Dynamic Analysis of Multi-Body Floating Platforms for Floating Offshore Wind Turbines

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The recent oil and gas supply shortages linked to global security challenges have shown that the climate change-driven transition to renewable energy is not only an environmental necessity but also crucial for political stability, economic resilience, and energy independence. Among the various sources of renewable energy, offshore wind has a vast potential that lies in deep waters. Unlocking this potential requires substantial advances in floating substructure technologies. Innovative technological solutions, industrialization and standardization that facilitate their mass production are essential to achieving economic viability.

In this context, the innovative Cable-Based Truss Spar (CBTS) floating platform for floating offshore wind turbines has been developed at the University of Rostock. The CBTS belongs to the new generation of floating substructures featured by a floater and keel connected via a cable-based suspension system. The design of this platform aims to enhance both static and dynamic stability, as well as its structural properties, for improved economic efficiency.

The current publication-based thesis introduces the concept of this platform and investigates its static and dynamic behavior through scaled model tests and numerical simulations using the open-source aero-hydro-servo-elastic tool OpenFAST and an in-house developed code. The first two publications investigated the nonlinearities of the taut mooring and suspension systems of the platform, as well as its hydrostatics, providing comprehensive methods for deriving the associated nonlinear stiffness matrices and restoring forces. The manuscript of the last research paper focused on the general static and dynamic analysis of the CBTS platform designed for the DTU 10 MW reference wind turbine (RWT), highlighting its advantageous static stability properties and discussing its dynamic response characteristics.