

**Title:** Influence of Thruster Response Time on DP Capability by Time-Domain Simulations

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### Abstract

Due to their simplicity static approaches are a commonly used method of assessing the DP capability of offshore vessels. These static approaches are essentially based on a balance of forces and moments caused by environmental conditions, as well as the thruster forces. The ensuing DP plots usually come up with unrealistically high application limits regarding admissible environmental conditions for a given operation. This phenomenon is due to the fact that important influencing factors are being neglected. One example is the assumption that the vessel is at rest and another one is the fact that the responsiveness of thrusters is not considered.

With the Voith-Schneider-Propeller an alternative propulsion system for DP applications is available. It differs from conventional azimuth thrusters primarily because of its faster thrust variation and thrust change over zero position. Since static approaches completely ignore this factor, this paper intends to quantify the influences of the response time of a thruster on the wind envelope with the help of time-domain DP simulations and the ensuing capability plots.

For this purpose comprehensive simulations have been carried out for an offshore support vessel while varying the dynamic thruster characteristics. Relevant assessments show that the response time has a significant influence on the DP capability and thus the operational window. It was found that results that are exclusively based on static approaches lead to incorrect conclusions both qualitatively and quantitatively.

Additional efforts to back up the simulation-based results regarding thruster responsiveness were made towards a full-scale validation. A direct comparison of two vessels with different propulsion systems is only partially suitable for a validation due to different set-ups in terms of thruster configuration and weather conditions. Instead, a large number of platform supply vessels in the operating area North Sea were analyzed for their DP capability with the help of historical positioning and weather data. The statistical analysis based on this data confirms the trends discovered in the dynamic simulation in all relevant aspects.