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Data driven digital twins for the maritime domain

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Digital twins are computational models that replicate the structure, behaviour and overall characteristics of a physical asset in the digital world. In the maritime domain, conventional approaches have relied on mathematical modeling (e.g. linearised equations of motion) and heavy computations for estimating ship resistance and propulsion, seakeeping and maneuverability and overall hull form optimization, treating the vessel as a point body. For instance, the ability to predict a vessel's future track in confined or congested waters presents a significant challenge due to the fact that as time passes, these models often fall out of sync with their digital counterparts due to changes that happen to the ship (e.g. foulding affecting maneuverability). In addition to this, mostly due to computational resources required, in real world deployments models are simplified, thus reducing their overall prediction accuracy..
In our work, we implement AI-enabled coupled abstractions of the asset-twin system, which rely on machine learning methods for constant learning of the evolving over time behavior of a vessel from historical data. The technical enhancements and practical performance improvements are demonstrated in a number of maritime industry pilots, aiming at real-time vessel traffic monitoring, short-sea autonomous vessel routing, etc. with the overall aim of global fleet intelligence.

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