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Weather Routing Model for Ship Motions Reduction and Fuel Saving

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When a vessel sails in a seaway, wind and current can influence the ship's speed, the comfort on board and the fuel consumption. Maritime trades are strictly dependent on the environmental conditions that the ships encounter during their sailing, safe navigation and energy efficiency are the key factors to improve the competitiveness and sustainability of ship operations. Optimization algorithms provide a significant support to the decision-making process and allow selecting the best route in sight of one or more objectives. The weather routing problem has been addressed by many authors and different approaches have been proposed. The new route optimization procedure will be developed on the shortest path algorithm in order to maximize the ship seakeeping performances and to minimize the added resistance caused by sea conditions. The optimization will be performed in accordance with two objective functions, the best routing solution is thus selected by the Dijkstra algorithm modified to take into account dynamically changing of ship's position and weather conditions. The maximization of a Seakeeping Performance Index, containing all the operability limiting criteria for induced vertical motions in rough sea, and of an Added Resistance Index, are the objectives to be achieved. The first for safe and comfortable navigation, the second for fuel saving, reducing the added resistance the engine power required to overcome the resistance and, as a result, the fuel consumptions decrease. The data of wind and sweel waves are derived, for each route segment, from global-WAM (GWAM) model. Results and discussion of the proposed method will be presented for a containership ship in a test case voyage through the Pacific Ocean, for ocean-going ships the voyage and sailing time are long and the weather conditions in the sea area around the route vary widely. The code can be integrated in an On-Board Decision Support System.

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