Simulation and analysis of the hydrodynamic interaction between unmanned vessels (vessel train)

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ABSTRACT

In recent years, the world of river-sea transport has hosted and continues to host new generations of large and powerful vessels. This evolution is mainly due to the increase in demand motivated by the cost of transport and the strong competition between shipowners.

In order to make this mode of transport more profitable and safer, new concepts have emerged. Among these concepts are the unmanned vessels train [1] and [2].

The concept of the vessel train is essentially to use a convoy of boats, the first of which is considered a master vessel and the others as followers (slaves). The first vessel transmits guidance information that the following vessels process and act upon.

Unfortunately, one of problems with this type of convoy is the consideration of external factors (wind, confinement, hydrodynamic interactions between vessels ...) which can considerably affect certain vessels of the train.

In order to better automate the manoeuvres of the slave vessels and to ensure a safe navigation, it is essential to identify and quantify the different hydrodynamic interactions between vessels, especially in a confined environment.

In this work, we conducted a series of numerical simulations using the CFD method with free surface for a train of unmanned vessels. These simulations allowed in one hand to study the resistance of the different vessels composing the train. In other hand, to perform a detailed analysis of the interaction between these vessels in maritime and river environment according to the speed of the convoy as well as the spacing between boats. The influence of confinement was also studied.

The results of this study allowed the implementation of a behavioural law that can be used to correct the commands of slave ships.

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