New Very Large Eddy Simulation Model in the Context of Fluid-Structure Interaction

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ABSTRACT

In the last decade in the field of simulation of turbulent flows, so-called hybrid turbulence models became increasingly popular. They combine the advantages of DNS, LES or RANS to reduce the costs and therefore they make it possible to solve complex industrial problems. The most popular hybrid turbulence model which has also been successfully used for many complex turbulent flow tasks is DES. It combines RANS mode in the attached boundary layers, with LES in separated regions and regions far from the wall [1]. The biggest problem of DES is the so-called grey area, in which an undefined modeling area exists, where the solution is neither pure RANS nor pure LES [2].

Han and Krajnovic [2] provide an alternative hybrid turbulence model, the so called new Very Large Eddy Simulation (VLES), which is based on the Speciale's VLES model [3]. This model switches between RANS and DNS depending on the grid resolution. The new VLES is able to give good predictions on a wide range of turbulent flow simulations on a coarse mesh in comparison to the LES [4].

Especially in the context of fluid-structure interaction problems (FSI) the problem of computational cost becomes much more significant. Therefore the use of hybrid turbulence modeling is particularly useful [5]. The use of DES in calculating FSI problems has been studied in several papers, while studies on the behavior of VLES model in the context of FSI are rare.

In the present work, the new VLES in the context of FSI will be applied. An inclining plate is investigated with this new method based on the k-ε and k-ω models. The results are compared to URANS and DES results. In addition, the results for different underlying models are discussed.

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