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Numerical Simulation of a Point Absorber Wave Energy Converter Using OpenFOAM in Indian Scenario

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Abstract : There is a growing need for alternative way of power generation worldwide. The reason can be attributed to limited resources of fossil fuels, environmental pollution, increasing cost of conventional fuels, and lower efficiency of conversion of energy in existing systems. In this context, one of the potential alternatives for power generation is wave energy. However, it is difficult to estimate the amount of electrical energy generation in an irregular sea condition by experiment and or analytical methods. Therefore in this work, a numerical wave tank is developed using the computational fluid dynamics software Open FOAM. In this software a specific utility known as waves2Foam utility is being used to carry out the simulation work. The computational domain is a tank of dimension: 5m*1.5m*1m with a floating object of dimension: 0.5m*0.2m*0.2m. Regular waves are generated at the inlet of the wave tank according to Stokes second order theory. The main objective of the present study is to validate the numerical model against existing experimental data. It shows a good matching with the existing experimental data of floater displacement. Later the model is exploited to estimate energy extraction due to the movement of such a point absorber in real sea conditions. Scale down the wave properties like wave height, wave length, etc. are used as input parameters. Seasonal variations are also considered.

Keywords : OpenFOAM, numerical wave tank, regular waves, floating object, point absorber
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