

1. In Introduction, there should be a sentence that defines the connection between the tidal turbine and the airfoil.

R1: Thank you for your suggestion. “Airfoil is the key element in the tidal current turbine blade, and the performance of the airfoil can significantly affect the performance of the tidal current turbine blade.”, which has been added to the Introduction (in Line 88 to 89).

2. There is an issue on the position of the abbreviations and nomenclature. Prepare the abbreviations list to the end, before References Section (suggestive, not compulsory to add it).

R2: Thank you for your suggestion. The abbreviations and nomenclature list has been added to the end.

3. In Section 1, authors should add some issues or try to address such limitations of the work, which this work conducted addressed in Conclusion.

R3: The issues from previous work are discussed as: (1) For the study object: “Most studies have focused on the power loss due to the increase of blade roughness caused by the impact of sand particles. Almost no study has been carried out on the hydrodynamic performance of tidal current turbine under water-sediment conditions, and a few researchers have made comprehensive simulations regarding to the effects of various variables on blade power under multiphase flow.”, which has been described in Line 50 to 54.

(2) For the study method: “Most of these numerical simulation methods are carried out in closed environments, such as fluidized bed, pipeline conveying. It requires further study whether the simulation methods are suitable for open environments.”, which has been described in Line 84 to 87. “Also, most of the experimental data are based on the wind tunnel or towing tank experiments, which lacks the verification of experimental data in realistic sea environment.”, which has been described in Line 58 to 60.

4. No graphical abstract was found but it is recommended.

R4: Thank you for your suggestion. The graphical abstract has been added in this revision.

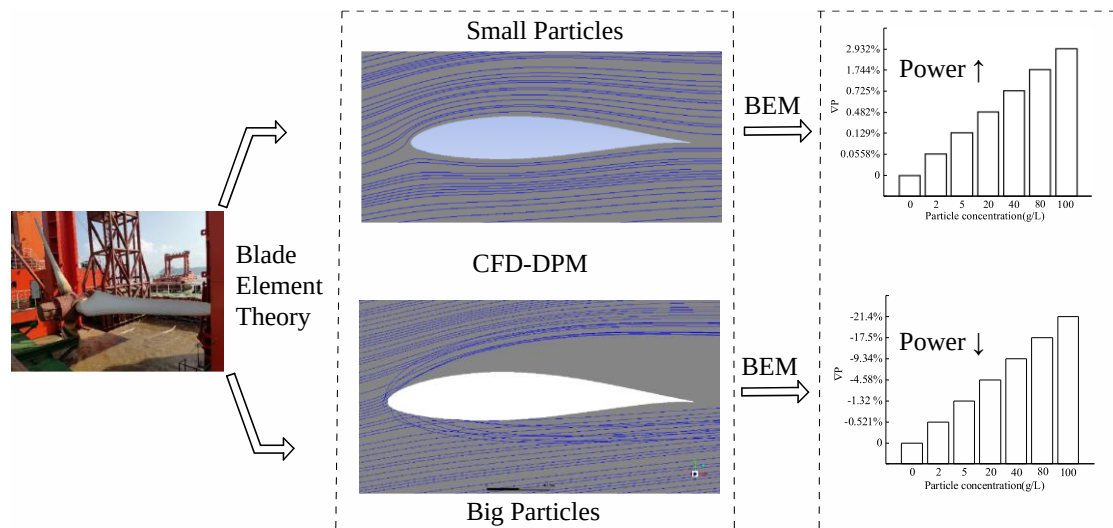


Fig The graphical abstract

5. In discussion, add some references too to explain some of the reasons to justify the work conducted. How were the metrics used in the DPM model chosen? **What are the considerations used to define the selected data relative to the tidal wind factor?**

R5: (1) The references [51], [52] and [53] have been added in this revision.

(2) The reason why DPM model was chosen: One particle replaces all particles with the same properties in a parcel, which will be beneficial for faster calculation and cost less computer resource. Also, The DPM model is able to capture the motion of every particle compared to the Euler-Euler model, so the DPM model is selected.

The detailed selection is in the DPM model: Two-way coupling was selected considering the particle-fluid interaction; The turbulent diffusion of the suspended sediment reaches a temporary equilibrium with the gravity of suspended sediment, so the gravity is negligible; since the particle diameter is greater than $10 \mu m$, the Saffman lift force can be neglected. Also, as the ratio of fluid density to particle density is low, neither the pressure gradient force nor the virtual mass force is taken into account.

(3) I don't understand the meaning of this sentence. Could you please enlighten me what do "the selected data" and "the tidal wind factor" refer to.

The relative velocity of tidal current is calculated according to the

$$U_t = \sqrt{(1-a)^2 v^2 + (1+b)^2 \Omega^2 r^2}, \quad v \text{ is the tidal current velocity, } \Omega \text{ is determined according}$$

the tidal current velocity and the optimum blade tip ratio, a and b are obtained during the blade design. The angle of attack I used in this study is the corresponding angle of attack when the lift-drag ratio is maximum.

6. The results in this work are quite sufficient on the study but can be improved with more discussion and references. Include more justification of the results by discussing them, maybe more comparative graph or profile plots on the findings, if possible. Include more technical discussion in the body's content in the paper by improving on the discussion.

R6: (1) The particle trajectories and the fluid streamlines when the particle diameter is $20\text{ }\mu\text{m}$ are shown in Figure 12. The particle trajectories are basically consistent with the fluid streamlines. The increased density caused small particle diameter is further verified.

(2) The relationship between the lift/drag coefficient and particle concentration was further studied, which has been added in this revision (in Line 387 to 397).

7. A limitation of the study is that authors did not define the methodology very well. Improve on the steps taken to produce the results.

R7: Thank you for your suggestion. In order to improve on the steps taken to produce the results, detailed analysis methods and ideas are added in the Abstract. “The analysis method is to analyze the influence of particles on fluid velocity first and then the change of lift/drag coefficient caused by the fluid velocity is analyzed.”

The scheme of this work is as following: Based on the blade element theory, the tidal current turbine blade is divided into a number of transversal airfoil elements; The CFD-DPM model is employed to simulate the lift and the drag coefficients of airfoil under different particle properties; The 120 kW tidal current turbine power is calculated based on the Blade Element Momentum theory under different particle concentrations.

In section 2: the governing equations for liquid flow and particle as well as the basic concept of airfoil are given. (1) Particle: The turbulent diffusion of the suspended sediment reaches a temporary equilibrium with the gravity of suspended sediment, so the gravity is negligible; since the particle diameter is greater than $10\text{ }\mu\text{m}$, the Saffman lift force can be neglected. Also, as the ratio of fluid density to particle density is low, neither the pressure gradient force nor the virtual mass force is taken into account. (2) Fluid: The SST $k-\omega$ model is selected. (3) BEM: 120 kW tidal current turbine power is calculated. (4) Airfoil: “The more the fluid velocity changes at the same streamline position, the greater the lift coefficient is” and “with the increase in relative velocity, the drag coefficient decreases” are the theoretical basis of analytical method. In general, the section 2 is the theoretical basis for the modeling in section 3 and the discussion in Section 4.

In section 3: Geometric modeling (described in section 2 Particle and Fluid theory), mesh generation, mesh independence verification and model verification (described in section 2 Particle, Fluid and BEM theory) are carried, which is the basic verification of multi-group simulation in section 4.

In section 4: (1) The CFD-DPM (described in section 2's theory and section 3's model verification) model is employed to simulate the lift and the drag coefficients of airfoil under different particle properties. The analysis method is to analyze the influence of particles on fluid velocity first and then the change of lift/drag coefficient caused by the fluid velocity is analyzed (described in section 2's “Airfoil”). The 120 kW tidal current turbine power is calculated based on the Blade Element Momentum theory under different particle concentrations (described in section 2's theory and section 3's verification).

8. English language check and editing is required. Some proof reading is needed, likely using a native English speaker or one with good English strength.

R8: Thank you for your suggestion. We have done the English language check and they have been marked in the revision.

9. Rewrite the last sentence in Conclusion. Replace "However, further investigation needs be done with considering the particle to particle interaction when at high particle concentration" with "However, further investigation needs be done by considering the particle-to-particle interaction under high particle concentration".

R9: Thank you! The last sentence in Conclusion has been corrected in this revision.

10. Also add reference to every equation presented that is not original to the authorship, appropriately. Make sure that all equations that are not original to the authors are referenced as cited.

R10: Thank you for your suggestion. The references about the equation (2-2) (2-4) (2-5) (2-6) and (2-13) have been added in the revision. And the references about the blade element momentum theory have been cited.

11. In Introduction, it should have more latest works on the subject area as it will improve its citeability and technical relevance. Add these <https://doi.org/10.3390/su12218768>; <https://doi.org/10.3390/inventions7010031>

R11: Thank you for your suggestion. These two references have been added to the study.