

Interactive comment on “CFD simulations to optimize the blades design of water wheels” by Emanuele Quaranta and Roberto Revelli

Anonymous Referee #2

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My major concern is the water wheel technology. Water wheel has been used as a energy generation device for hundreds of years, why the authors still stick with this technology instead of using turbines and other advance hydro-kinetic devices? The authors have to convince the readers that (1) the presented water wheel is a competitive energy technology comparing to the advance hydraulic energy conversion technologies; and (2) the paper does bring some original contribution on the existing knowledge base. The authors mentioned that the water wheels have "several advantages over turbines" but did not support this statement with enough proofs.

I also have questions about the benchmark of the optimal design. The authors displayed three wheel profiles to compare, how the three profiles were selected? why not other shapes (3D spiral etc.)? How the dimensions were determined? what if we change the radius of the circular profile or the curvature of the elliptical profile? It is not

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convincing that the listed profiles and dimensions would necessarily lead to the optimal performance.

From the results, by using the circular profile, the momentum increasing was only 5.6% but it may cause extra cost in fabricating water wheels with complex shapes, is it feasible to design and fabricate circular wheels for only 5.6% increment?

A complete research paper should include at least two ways to "proofreading" the obtained results. A section of experimental study and a detailed demonstration of experimental results and comparison of the experimental results to the numerical results are necessary!

The CFD simulation part needs more information, what software was used for modeling and simulation? what types of element (2D? 3D?) were used to mesh the model? What material properties were used for modeling the water/fluid and the water wheel/solid?

The topic of hydropower generation technology and water/paddle wheel design optimization has been visited by many researchers. The authors at least need to pay attention to some recent studies:

1. Akinyemi and Liu, "CFD modeling and simulation of a hydropower system in generating clean electricity from water flow", International Journal of Energy and Environmental Engineering, 6, 2015.
2. Akinyemi, Chambers, and Liu, "Evaluation of the power generation capacity of hydrokinetic generator device using computational analysis and hydrodynamic similitude", journal of power and energy engineering, 3, 2015.
3. Liu and Peymani, "Development and computational verification of an analytical model to evaluate performance of paddle wheel in generating electricity from moving fluid", Distributed generation and alternative energy journal, 30, 2015.
4. Liu and Peymani, "Evaluation of paddle wheels in generating hydroelectric power", IMECE2012-85121, IMECE 2012, Houston, TX, USA, 2012.

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Some minor typos or grammar errors:

1. P4, ln 120, “manufacture process” should be “manufacturing process”.
2. Ln 126, was the optimal radius 0.25 m randomly picked?
3. How were the dimensions of profile 2 and 3 determined?
4. Section 2.2 is duplicate, needs to be renumbered.
5. Pg 5, ln 162, should be “as shown in Fig. 4”.
6. Ln 163, should be “different blade numbers”.
7. Ln 202 “is to prefer to” should be “is preferred to”.

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