Wind Energ. Sci. Discuss., referee comment RC2
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Comment on wes-2021-108

Anonymous Referee #2

Referee comment on "Fast yaw optimization for wind plant wake steering using Boolean yaw angles" by Andrew P. J. Stanley et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-108-RC2, 2021

General comments

The manuscript contains a description and numerical assessment of an algorithm for yaw angle optimization for wind plant wake steering. The authors claim to propose a new Boolean optimization method based on a greedy approach. The algorithm is not accompanied by any theoretical considerations regarding convergence and the ability of the algorithm to find feasible or optimal points. Hence, it should be classified and referred to as a heuristic and not as a method. Secondly, given the vast literature on heuristics for nonlinear 0-1 optimization problems it is surprising that the authors (i) do not include any references on that topic, and (ii) choose such a trivial algorithm and do not investigate other alternatives.

Based on the literature review and the simplicity of the problem formulation (e.g. lack of constraints) one can wonder if the considered approach reaches state-of-the-art in the field. It is of course sometimes relevant to use simplified models, but one of the main arguments in the introduction is to achieve a realism. The authors should clarify.

Several of the numerical experiments are based on artificial wind farms or wind scenarios that are unlikely to appear in a real world application, e.g. random turbine positions and turbines perfectly in-line with the wind and a single wind speed. Even if this is good for reproduction of the results, it is dubious if these examples can be used to make general conclusions that are applicable to real world wind farms. The authors are encouraged to extend the numerical experiments with these comments in mind.

One of the main conclusions from the manuscript is that the proposed greedy algorithm is much faster than a traditional method, in this case SQP applied to a continuous version of

the problem. There are several issues with this conclusion. Firstly, the two algorithms attempt to solve different problems and meet different requirements and are as such not comparable in a fair way, particularly when it comes to computational effort. Secondly, the implementation of the call to the SQP method is based on finite difference approximations of the gradient of the objective function. This is well known to have potentially very large implications on the computational time per iteration, the robustness of the algorithm, the achieved accuracy, and the number of iterations when the number of variables increase. How much the implementation choices affect the outcome is not reported. It is therefore possible that the differences in computational time are entirely attributed to the implementation rather than the method itself.

Specific comments

The authors claim to propose a Boolean formulation. This formulation is not formally stated in the manuscript. The optimization problem that is stated is in fact the continuous problem on line 90. Please clarify.

The authors argue that the proposed optimization formulation is novel. However, the literature review mentions that others have considered several discrete choices of angles. It seems that the Boolean approach would be a special case. Please clarify.

The statement on page 8 line 167 "… time is seen to increase exponentially with increasing design variables." is not properly motivated and most likely not correct. It is much more likely that the increase in time is polynomial given the type of problems and the method employed. The authors should confirm that the increase is indeed exponential or revise/remove the statement.