Date: December 8, 2023

First of all, we would like to thank the reviewers for their comments and recommendations. Certainly, these have helped us to enhance the quality of our manuscript. As follows, we provide detailed answers to the reviewers.

Clarifications: For the response letter below, we use the following color code: reviewer's original question/comment in black, responses to reviewer in blue, and text being added to the article in magenta.

Reviewer # 1

General comments

This article discusses a tool/technique to generate meshes for boundary integral methods (particularly vortex-lattice methods), specifically tailored for application in wind turbine/wind farm applications. It might be of interest to research groups starting to develop their own numerical solution methods in this application area. Although not describing scientific breakthroughs, this article gives a nice insight into the different aspects involved in creating a 'simple' meshing tool that can also be used in parametric wind turbine and wind farm studies. The article discusses very specific approaches to geometry definitions focused on wind turbines. Although currently limited in options, it should be possible to extend the accompanying open source tool to more general geometry manipulations. The section 'Numerical Results' is interesting as it demonstrates the power of parametrized potential flow simulations for which a simple 'automated' mesh generation tool is indispensable. The results shown are generated with VLMSim.

Response: Your comments are appreciated. Through our revision, we hope that we have managed to make clearer the different aspects requiring further attention.

Specific comments:

1. Although very interesting for aerodynamicists like myself, it is advised to condense the section 'Numerical Results' as the focus should be on mesh generation. Another way to solve this issue is to retitle the article into something like "Development and application of a mesh generator for unsteady vortex lattice method simulations of wind turbines and wind farms".

   Response: Thank you very much for this observation. As the reviewer has suggested, we have changed the title of the article to make it more consistent. The new title is as follows:

   "Development and application of a mesh generator for unsteady vortex lattice method simulations of wind turbines and wind farms"

2. The detailed description of a specific implementation of a UVLM method in section "Unsteady vortex-lattice method" should be removed. This article discusses a MESH GENERATOR for potential flow (UVLM) methods. References to implementation(s) would suffice.

   Response: Thank you very much for this observation. Regarding the section "Unsteady vortex-lattice method", we truly believe that providing a brief recap of the method and its connection with some of the parameters described in the section "Geometric modeling" is valuable for the community working on these topics. Mostly to introduce concepts and to fix notation required without elaborating unnecessarily. Specifically, a complete and self-contained paper on this topic could greatly facilitate the learning process and accelerate the

sue of the Mesh generator by PhD and Master students developing research tasks in the context of UVLM applied to wind turbines and wind farms.
However, we also agree with the reviewer that the current location of the “Unstable Vortex Lattice Method” section may make the article difficult to read and hide and/or mask the main objective of the article. In order to improve the quality of the article following the reviewer's suggestion, the section “Unsteady vortex lattice method” was moved to an appendix at the end of the article.

Technical corrections:

1. Format single references like (Roccia, 2023) and multiple references like (Nigam et al., 2017; Liu et al., 2017). Sentences starting with a reference should not include the parentheses.

   Response: Thank you very much for this comment. We have fixed all the issues related to the references.

2. For more detailed comments, see attached annotated pdf

   Response: Thank you very much for the extensive and careful review of our article. All your comments are of great value to us and will help increase the quality of the manuscript without a doubt. All comments, corrections and suggestions made in the PDF have been considered, properly attended, and implemented in the corrected version of the manuscript.

Reviewer # 2

General comments

his article presents an open-source tool for the generation of mesh sections of a generic (onshore or offshore) floating wind platform geometry for application in panel-method or unsteady vortex lattice method (UVLM) solvers. The overall presentation of the material is good and is certainly very easy to follow. The developed tool has application to the generation of meshes for the aforementioned solver types and can be easily applied, such that developers or users of the software do not themselves have to generate the modules necessary for this. It is unfortunate that the code is written in matlab rather than something more generally available and applicable such as python, as this would greatly increase the user base.

Response: Your comments are appreciated. Through our revision, we hope that we have managed to make clearer the different aspects requiring further attention.

1. Although for the application of a potential-flow based method it is certainly aesthetically pleasing to have a surface mesh generator for all turbine surfaces, the scientific relevance of using the tool in these regions (with the exception of the blade mesh generator) is questionable. Many of the regions for which this tool generates meshes are not suitable for the application of potential flow methods as the flow will either be separated (e.g. downwind sections of the nacelle, tower or blade roots) or will have a negligible contribution to turbine loads. Furthermore, it is difficult to imagine scenarios where a potential-flow based solver will be practically applicable to the ground-meshes which this tool generates.

   Response: Thank you very much for this comment. As the reviewer has indicated, flow separation is not accounted for in those non-lifting regions (such as the tower, nacelle and hub). Furthermore, standard implementations of vortex-based methods are not able to predict aerodynamic loads on airfoils having thickness and forces on non-lifting bodies. However, by changing the type of singularity used to represent the potential function on the bound lattices and working on the unsteady Bernoulli equation, it is possible to calculate pressure distributions (and therefore forces) on non-lifting surfaces (see [1]).

In this sense, meshing lifting- and non-lifting surfaces has two main purposes: i) apply the non-penetration condition all over the wind turbine, thus guaranteeing the non-penetration of the flow through the structure during yaw maneuvers for example, and ii) provide a detailed geometric modeling of the entire wind turbine, which can be used with different potential flow solvers (vortex methods, panel method, etc.). Furthermore, the mesh generator tool presented in this work allows incorporating pre-bending and pre-sweeping of the blade while keeping the arc length for all curved blade shapes equal to the original length. This capacity allows us to generate pre-curved/swept blades in a faster and more versatile way, maintaining their original length, thus avoiding blade extensions. To the best of our knowledge, such nonlinear blade geometry generator intended for potential flow solvers is not available in the community.

We agree with the reviewer in that the interaction between the tower and the wake are not properly considered in this work in terms of the aerodynamic results presented. However, according to the best of our knowledge, meshing the tower is not a questionable point, since it could clearly prevent the wake from penetrating the tower using a particle-vortex method such as that used in [1].

With respect to ground meshes, this module can also be used to generate the mesh of sea waves and its kinematics. This will allow us for example to study the influence of such sea waves on the shape of the wakes (and therefore on the aerodynamic loads on the turbine). Having a sea wave mesh can be used with a solver based on the panel method to estimate loads on the substructure of the wind turbine. Although this capability is not yet available in UVLMeshGen, students at UiB are currently working on this matter and this is expected to be included along with future releases.

The purpose of this meshing tool is not to produce meshes for a particular solver, but rather to provide a complete meshing tool to the community that works with different potential flow solvers.

[1]. Willis, D.J., An Unsteady, Accelerated, High Order Panel Method with Vortex Particle Wakes, PhD thesis, Massachusetts Institute of Technology, USA, 2006.

2. The general formulation of the paper, although well-structured and easy to follow is somewhat confusing. The article is very long, and the main contribution (as given in the title) is the mesh generator, however a significant portion of the paper is devoted to aerodynamic simulations within the solver VLSim. Although it is mentioned that the purpose of this is simply a demonstration of the application of the mesh generator, this would have been more directly achieved by simply generating a range of meshes and comparing these so similar tools such as GMSH with appropriate mesh metrics. The simulations in section 5 have a “try-and-see what happens” style which does not go further towards the goal of demonstrating the capabilities of the meshing tool. The simulation in Section 6 are similar, however also raise questions as to the accuracy and applicability of the VLSim solver.

Response: Thank you very much for this comment.

Although the GMSH tool could be used to mesh an entire wind turbine, the complete process would certainly take some time. Furthermore, GMSH cannot be used as a versatile and fast tool to obtain different wind turbines by changing some key parameters such as: cone angle, pre-bend, pitch angle, number of blades, airfoils, twist angle, etc.

The meshing tool presented here is not intended to have a similar capacity and/or produce meshes of similar quality to FEM-oriented mesh generators, but rather to provide meshes of wind turbines/farms, well-suited for potential flow solvers, in a fast and parametric way. Furthermore, the tool developed in this work is suitable to be used in optimization studies due to its parametric meshing capacity.

Regarding the section of numerical results, in particular those included in subsections 5.5 and 5.6, we have, respectfully, a rather different perspective. On this matter, we agree with the first reviewer in that: "the complete numerical results section is important as it demonstrates the power of parametrized potential flow simulations, for which a simple "automated" mesh generation tool is indispensable".
To the best of our knowledge, there is to date no freely-available a parametric mesh generator of arbitrary wind farms intended for potential flow solvers that allows for: i) designing wind park layouts; ii) considering different wind turbines (with their own design parameters); iii) including the terrain topography and/or the sea surface description; and iv) computing the wind farm kinematics.

Last but not least, we understand the reviewer's concern about the accuracy and applicability of VLMSim. Although VLMSim is not the main focus of this paper but rather a tool that allows using the meshes generated by UVLMeshGen, VLMSim has been extensively verified and validated for several years and documented in the following articles. Particularly the last article of the list presents an comprehensive verification of the employed tool.

[1]. Roccia, B. A., Preidikman, S., Massa, J. C., & Mook, D. T. (2013). Modified unsteady vortex-lattice method to study flapping wings in hover flight. AIAA journal, 51(11), 2628-2642.

[2]. Verstraete, M. L., Preidikman, S., Roccia, B. A., & Mook, D. T. (2015). A numerical model to study the nonlinear and unsteady aerodynamics of bioinspired morphing-wing concepts. International Journal of Micro Air Vehicles, 7(3), 327-345.

[3]. Roccia, B. A., Preidikman, S., & Balachandran, B. (2017). Computational dynamics of flapping wings in hover flight: a co-simulation strategy. AIAA Journal, 55(6), 1806-1822.

[4]. Roccia, B., Verstraete, M. L., Dimitriadis, G., Bruls, O., & Preidikman, S. (2018). Unsteady aerodynamics and nonlinear dynamics of freefalling rotating seeds. In International Conference on Noise and Vibration Engineering, ISMA 2018. KUL, Leuven, Belgium.

[5]. Verstraete, M. L., Roccia, B. A., Mook, D. T., & Preidikman, S. (2019). A co-simulation methodology to simulate the nonlinear aeroelastic behavior of a folding-wing concept in different flight configurations. Nonlinear Dynamics, 98, 907-927.

[6]. Verstraete, M. L., Ceballos, L. R., Hente, C., Roccia, B. A., & Gebhardt, C. G. (2023). Code-to-Code Benchmark for Simulation Tools Based on the Unsteady Vortex-Lattice Method. Journal of Aerospace Information Systems, 20(11), 719-746.

Specific comments:

1. If the purpose of the article is to validate the VLMSim solver, I recommend modifying the title appropriately and including many more details of the simulation carried out (e.g. spatial and temporal discretisation, simulation length, vortex parameters etc) and comparing to other high-er-order solvers.

   Response: Thank you very much for this comment. As mentioned above, the main focus of the article is not a comprehensive aerodynamic study of wind turbines and/or wind farms, but to present a parametric meshing tool suitable for potential flow solvers. The importance of the numerical results section simply demonstrates the power of parameterized potential flow simulations, for which a simple "automated" mesh generation tool is indispensable.

In order to improve que quality and consistency of the article and following the reviewer's suggestion (also pointed out by the first reviewer), we have modified the title of the manuscript as follows:

"Development and application of a mesh generator for unsteady vortex lattice method simulations of wind turbines and wind farms"

As the reviewer suggested, we have included more data regarding the simulations carried out.

2. If the purpose of the article is to introduce the mesh generator, I would recommend greatly reducing Sections 5 and 6 and including mesh comparisons and removing aerodynamic investigations.

   Response: Thank you very much for this comment. In order to make the main objective of our article (the mesh generator) compatible with the aerodynamic results section, we follow here the suggestion of the first reviewer, which consists of modifying the title of the article.

3. Is there any reason why triangular mesh elements have not been used? These are also easily applicable within potential-flow based models.

   Response: Thank you very much for this observation. The purpose of the paper is to present the main idea of a parametric mesh generator intended for wind turbines/farms. UVLMeshGen is an open-source project, currently available in a GitHub repository, which aims to encourage the community working with potential flow solvers to contribute to the project by adding new capabilities and/or improving the existing ones.

   In the case of triangular elements, we have not excluded them for any particular reason, except for certain technicalities when computing aerodynamic loads on these elements. In this sense, the community is encouraged to extend the capacity of UVLMeshGen by adding new features to it.

Technical corrections:

1. A number of spelling and grammatical mistakes have been found- please refer to the attached pdf.

   Response: Thank you very much for the extensive and careful review of our article. We have reviewed the entire article and fixed and corrected all grammatical errors we found.

2. One or two problems with wind-energy specific nomenclature- please refer to the attached pdf.

   Response: Thank you very much for this observation. We have gone through the article and addressed any inaccuracies in wind energy nomenclature.