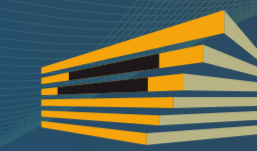


Wind3D | Wind field prediction at local scale



TYPE OF R+D RESULT

- New technology
- New product**
- New service
- New knowledge or skill



COMMERCIAL MATURITY LEVEL

- Model or conceptual idea**
- Proof of concept (design)
- Validated in a controlled environment
- Validated in a real environment
- Successfully implanted



PROTECTION LEVEL

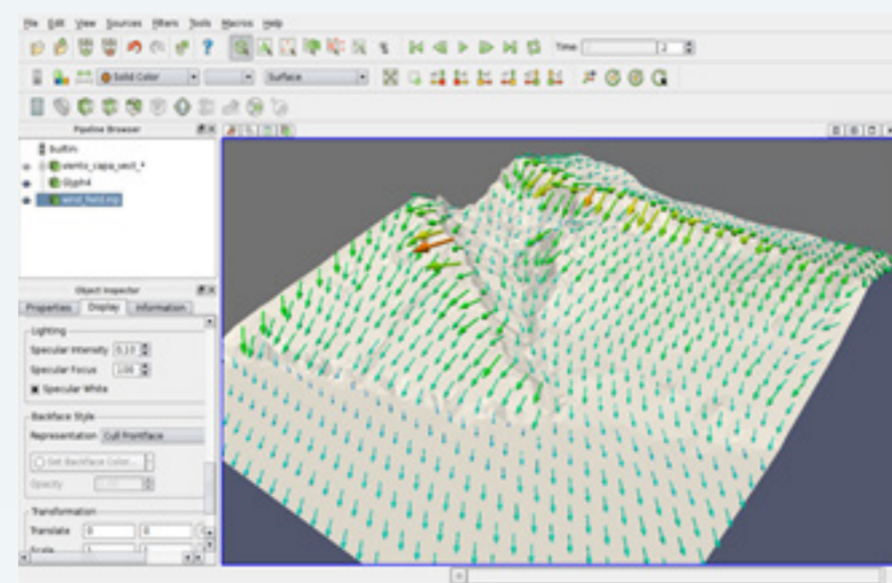
- Non- applicable
- Patent
- Software**
- Know - how
- Utility model

Description of the solution. Problem solved

Wind models are tools that allow to study different problems related with the atmosphere, such as studying how the wind affects to a determined structure, pollutant dispersion, location of wind farms or fire spreading. This way, wind models are becoming increasingly important tools for coping efficiently with a wide range of social, politic and economic problems, and high expectations are placed upon them.

Thus, in order to offer means that allow to study and simulate wind fields the present solution is introduced. It is a software for prediction that can calculate the wind field of any area of interest, always using another known field as a base whether they are specific meteorological stations or predictions from a numerical weather prediction as the European Centre for Medium-Range Weather Forecasts (ECMWF.) [This European model is executed each 12 hours and is capable to elaborate weather prediction 10 days in advance.]

In order to work, the software takes into account the physical processes that rule the wind profile in atmosphere and terrain. To do so, the following data need to be collected or introduced in the system:



- (1) Tetrahedral mesh of the calculation domain.
- (2) Map containing both land roughness lengths and displacement heights.
- (3) Wind values (speed and direction).

The result obtained by analysing this information is a model or representation reflecting the wind field in all the nodes of the tetrahedral mesh. Also, certain points can be specified for knowing the wind field.

Indeed, this software, which is called Wind3D and is marketed under licence, is a program that calculates wind fields in a three-dimensional domain from certain data. This calculation domain is limited in its lower part, by the ground or land to be studied; and on the upper part the analysis limit is risen to the desired height.

This solution is very interesting for generating database of the most probable wind configurations in a specific region. Also, it can be applied to any scenario where wind is important and no measures of the area of interest are available.

Some applications of this solution are listed below:

- Calculation of the wind fields in wind parks. This allows to assess power produced by a wind turbine depending on its placement and to compare it with the curves given by the manufacturer.
- Identification of optimal locations for wind parks.
- Studies on pollutant dispersion in the atmosphere.
- Study on the dispersion of seeds of certain plants that make possible the survival and dispersion of these plant species, as well as flying insects.
- Spread of forest fires. Wind affects the wildfires spreading since it can stop them or accelerate them.
- Analysis of the wind effects on livestock. In this case, the combination of wind and low temperatures has a negative impact on livestock. Also, the wind has an impact on food reserves of animals and their strategies for hunting and defence.
- Prediction of transmission capacity of overhead power lines.

Fields of commercial application

This solution can be of great interest for the following sectors:

- Managers of wind parks. Managers of wind parks may predict the energy generation by the calculation of the natural resource done by our software.
- Managers of electricity networks. Wind's prediction may allow managers of electricity networks to control the imbalances caused by renewable energies, as well as to manage generation and storage systems.
- Managers of infrastructures. Knowing the wind forecast in severe adverse events is vital for some infrastructures as, for example, airports.
- Public institutions. This solution may be of interest for agents related to environmental protection and, more particularly, to those controlling spreading of forest fires and fighting against atmospheric pollution.
- Environmental consulting. This software may be useful for environmental studies.
- Other. The solution may be also used for livestock protection by livestock farmers.

Market opportunity

Study on wind fields is an open research line in which currently several research groups are working on. As a proof of the relevance of the market's interest on this kind of software, the Institute of Intelligent Systems and Numeric Applications in Engineering (SIANI) of the University of Las Palmas de Gran Canaria has signed agreements with several companies for using this software.

In this line, companies on wind energy industry need more sophisticated tools that allow them to face the requirements of a growing market more competitive and demanding. Thus, within the wind energy frame, the Spanish Wind Energy Association points that Spain has established itself as the fifth global wind energy power in 2020 since it reached 27 GW of cumulative capacity of installed wind energy and has a technology valued in

AUTHOR
Gustavo Montero García; Rafael Alejandro Montenegro Armas; José María Escobar Sánchez; Eduardo Rodríguez Barrera; Albert Oliver Serra

CONTACT
Oficina Transferencia de Resultados de Investigación (OTRI)
@ arivero@fpct.ulpgc.es
☎ 928 45 99 56 / 43

<https://otri.ulpgc.es/>

approximately €2,100 million.

Considering the above data, it is a fact that this software is indeed very useful for local agents from local areas (simulation of wind fields are very difficult to be done in Canary Islands due to their terrain), as well as national areas, since Spain has more than 220 centres of wind energy manufacture. In addition to this, since main powers in wind capacity are located in Europe, this solution may be of interest for the Community too.

Competitive advantage

Due that Wind3D uses the finite element method for solving this problem, a better resolution can be obtained with little computational cost, that implies a quicker response and a reasonable quality of the model. In addition to this, this software is able to provide ad hoc forecast, that means predictions on certain spots or areas determined by the client depending on their interests.

Concerning to this solution, it should also be said that a vital advantage of this software is the know -how of the Division of Advanced Numeric Algebra and the Division of Discretization and Applications of the Institute of Intelligent Systems and Numerical Applications in Engineering (ULPGC). The research staff of these divisions have a deep knowledge and skills acquired during their respective professional background, particularly in the study of wind fields.