
Materials Information Technology Challenges With Wind Turbine Technology

A CUSTOMER CASE STUDY

The Challenges of Wind Turbines

Wind has been used as a source of power for centuries. Today wind turbines are the fastest-growing sector of the renewable power business. But, as this case study from one of Granta's customers makes clear, seeking to reduce the cost of each kwh means the latest wind turbine technology pushes new materials to their limits and provides real materials information management challenges.



The blades are the most vulnerable parts of a wind turbine, and there is a desire for ever longer blades (to increase the area and thus power). The self-weight of the blade creates alternating bending loads at the blade root as the turbine rotates. Superimposed on these is an axial load caused by centrifugal force and a bending load caused by wind pressure. The necessarily complex composite materials needed are being developed and tested by R&D teams who need quick and reliable access to the full range of characterization, simulation, and testing data.

Granta Design have been working with a leader in this field to help them accelerate the development and implementation of new composite materials systems that enable bigger, lighter, and more reliable blades. Test and design data relating to composites are crucial to optimizing the structure and shape of blades, and other key components. However, such composites data can be complex and difficult to manage and use: the advanced characterization, analysis, and certification of these highly specialized material systems requires a great deal of qualification, testing, analysis, and modeling. The complexity is only increased by the variation of composite material properties with factors, such as geometry and process history, that are specific to each application.

As a result, huge amounts of valuable materials-related information are produced and need to be managed, accessed, and applied efficiently. To ensure accuracy, consistency, and traceability, designers and engineers also need to be able to track design data back through the statistical analysis process to the raw test data. They also want to be able to reuse pre-existing data to increase efficiency.

As is typical in many engineering enterprises, this information has often been stored in Excel spreadsheets on engineers' PCs or the corporate network. This made it a time consuming process to find and apply this information at the next stage of testing, design, or analysis. As quality is all-important, there was a strong desire to eliminate any scope for the error that can arise when manually entering complex data into Finite Element Analysis (FEA) models. Enterprise-wide application of consistent data is also important, to avoid variations in design, modeling, or simulation.

A materials information management system

Granta have been able to provide the company with a materials information management system, ensuring that all data is stored in a single, traceable, and fully searchable system. Materials experts working with blade technology are now using this system to collect and maintain data from in-house tests, such as compression, IPS, ILLSS, rheology, environmental, together with its pedigree and analysis details, within this corporate materials information resource. They are then able to provide quick and reliable access to this data in the right format for those who need it.

The company concerned is an international organization, so this materials information needs to be disseminated to groups working around the world. Now engineers and designers can easily access and apply this data, wherever they are, from within their web browsers. Those involved in engineering simulations can smoothly import this data to their familiar ANSYS FEA environment, saving time and ensuring data consistency, accuracy, and traceability across the enterprise.

Implementing a new materials information management system has also helped standardize processes relating to materials data and analysis. With a growing organization, such consistency is becoming increasingly important, and is now in place for complete range of pedigree and process information, as well as test, statistical, and design data.

Having one “gold source” of materials information has increased confidence in the materials data used by wind blade engineers, and is capturing the corporate materials expertise and knowledge. Together, these help with innovative designs involving lower carbon fiber content, reducing the cost and increasing the efficiency of turbine blades.

The benefits seen through using GRANTA MI to support the development of turbine blades can equally be expected when it is used in other areas of wind turbine development, including towers, drivetrains, and nacelles. With pressure on wind energy companies to reduce the cost per unit energy, an industry leading materials information management system forms an essential part of their development process, and is helping them to maximize their materials and design expertise as they seek to make wind an energy source on a par with fossil fuels.

Further links

GRANTA MI product information: www.grantadesign.com/products/mi/

Granta's solutions for energy industries: www.grantadesign.com/solutions/energy/

View this Case Study online: www.grantadesign.com/news/news/reports/wind.shtml