Optimising Wind Farm Operations and Maintenance with Advanced Modelling and Simulation

Industry: Sustainable Energy

ABOUT

Supporting clients to develop and implement energy transition strategies, **Paragon Labs** are making sustainable, climate-positive business a reality at the industrial scale. With their extensive experience of renewable technologies, from offshore wind to innovative fuel cell solutions, Paragon are relied upon by investment funds and industrial groups to provide the knowledge and tools to successfully execute large-scale energy-transition projects.

THE CHALLENGE

Offshore wind is one of the largest sources of renewable energy and a key area of interest for Paragon Labs and their clients. To get a complete understanding of the multitude of factors that contribute toward the technical and financial performance of a wind farm, the challenge for Jean Lemaire, CEO and Founder of Paragon Labs, was to design and develop a complete software package for modelling offshore wind operations.

The model would have to connect a large variety of different types of data and determine their effect on each other. Meteorological conditions, equipment reliability characteristics and investment in maintenance resources all interact and can have a significant impact on the profitability of a project, making this a complex modelling challenge.
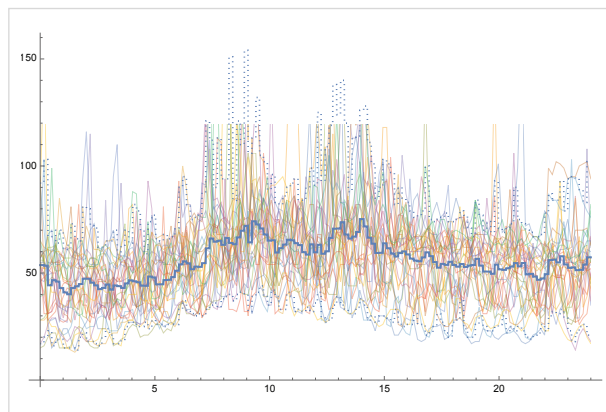
THE APPROACH

What was needed was a computation environment that could provide industrial-grade reliability at scale, making the Wolfram System the clear choice. Having tried traditional programming languages, Jean found they had significant reliability and performance issues when, for example, computing ratios of large factorial numbers or exponentials.

Wolfram removed these limitations and added a number of other core capabilities, including advanced visualisation tools and robust statistics and data analysis functionality.

Paragon took advantage of the symbolic nature of the Wolfram System to process datasets of meteorological and ocean data consisting of hundreds of thousands of data points.

Once the data had been cleaned, Paragon Labs then used Wolfram to analyse the datasets, deriving statistics and fitting distributions and parametric models to compute persistence metrics—the probability that a given event lasts for a certain amount of time.

By using built-in functionality, much of the work was automated, greatly reducing the time and resources spent on writing low-level code. As an example, Jean used time series objects and their associated functions in the Wolfram System to quickly convert disparate datasets and make them usable by their discrete-event simulation system.

> "*Since 2011, the Wolfram System has been a powerful and feature-rich technical computing development platform to design and experiment with software and algorithms dedicated to offshore wind farms and wind farm operation and maintenance strategies.*
>
> *After experiencing the computing limitations of more traditional computing environments and languages, I switched to Wolfram for its extensive and continuously-updated libraries of industrial-grade functions, elegant visualizations, advanced data analysis capabilities and unparalleled connectivity with external data sources.*"

—Jean Lamaire
CEO & Founder, Paragon Labs

ACHIEVEMENTS

Rapid Development & Quick Project Delivery

Wolfram's time series, probability and statistics functions all combined seamlessly, enabling Paragon Labs to develop complex and powerful data processing capabilities rapidly and efficiently. The parallel computing capabilities and functional code development approach made possible by Wolfram accelerated development of the project and provided Jean with the freedom to focus on innovating.

A Reliable, Robust Model for Simulating Wind Farm Operations

By switching to Wolfram, Paragon Labs have been able to create an industry-grade application, without the negative performance and security implications introduced by the patchwork of packages that would be required with a traditional, open source language.

Deployed in the Field by Global Energy Leaders

The software developed by Paragon Labs has been deployed in the field to assist and support multi-billion Euro development projects in European offshore wind by global energy and utilities organisations.

TAKE YOUR PROJECT TO THE NEXT LEVEL

From data analytics to modelling, publishing APIs to developing neural nets, exploring new ideas to large-scale deployment…

Find out how the Wolfram System can transform your workflows and jump-start your projects.