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*Editorial*

# Special Issue "Numerical Simulation of Wind Turbines"

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To fulfill global needs for a more sustainable energy, a further development of wind energy is fostered. Wind turbines represent the largest rotating machines on Earth and their upscaling trend is expected to continue in upcoming years. On the other hand, even small wind turbines [1,2] can play a role in a future energy scenario of distributed energy production, especially in combination with other renewable energy sources in proximity of populated areas [3] served by a smart-grid logic: in these applications, novel concepts and designs are also under development [4–7].

Overall, it is undisputed that wind energy has become a consolidated industry, with the connected benefits and drawbacks. Among the latter, it is apparent that the complexity of wind turbines and their installation in challenging, open environments imply the need of accounting for a variety of "side-issues" that go beyond the pure engineering design of the turbine, such as, for example, the interaction with the atmosphere and the wake of other machines [2], the grid integration, or the effects of environmental conditions [8,9]. As a matter of fact, as the development of wind energy requires a multi-disciplinary approach, it is the combination of several areas that make things happen and that often defines new scientific challenges [10].

At the moment, however, a truly holistic approach to wind turbine design is still missing. To achieve it, it is apparent that simulation will play a key role since it represents the common framework, within which the different disciplines and sciences can communicate. Developments are needed in each of them, from more accurate but computationally affordable simulation techniques [11,12], to innovative control logics [13] or effective methods for noise prediction [14]. Focusing more specifically on aerodynamics, it is apparent that the use of high-fidelity computational techniques is key to properly model the new generation of long and flexible blades, where aero-elastically-tailored designs are needed, and different flow control devices are often used to alleviate the loads [15,16]. As discussed, all these new methods and tools, however, should be developed synergically by the different groups of specialists, in view of that integration that represents the only way of properly addressing the reliable modeling of such a complex system like a wind turbine.

The contributions from the research works included in this Special Issue offer new data, information, and findings to continue the R&D effort in wind turbine simulation, with the aim of stimulating the research community to further contribute to the development of the field. Sincere thanks are, therefore, due to all the authors that contributed with their works to this Special Issue.

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