Wind energy systems [optimising design and construction for safe and reliable operation /

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Monografía

Large-scale wind power generation is one of the fastest developing sources of renewable energy and already makes a substantial contribution to power grids in many countries worldwide. With technology maturing, the challenge is now to increase penetration, and optimise the design, construction and performance of wind energy systems. Fundamental issues of safety and reliability are paramount in this drive to increase capacity and efficiency. Wind energy systems: Optimising design and construction for safe and reliable operation provides a comprehensive review of the latest developments in the design, construction and operation of large-scale wind energy systems, including in offshore and other problematic environments. Part one provides detailed coverage of wind resource assessment and siting methods relevant to wind turbine and wind farm planning, as well as aeroelastics, aerodynamics, and fatigue loading that affect the safety and reliability of wind energy systems. This coverage is extended in part two, where the design and development of individual components is considered in depth, from wind turbine rotors to drive train and control systems, and on to tower design and construction. Part three explores operation and maintenance issues, such as reliability and maintainability strategies and condition monitoring systems, before discussing performance assessment and optimisation routes for wind energy systems in low wind speed environments and cold climates. Part four reviews offshore wind energy systems development, from the impact of environmental loads such as wind, waves and ice, to site specific construction and integrated wind farm planning, and of course the critical issues and strategies for offshore operation and maintenance. With its distinguished editors and international teams of contributors, Wind energy systems is a standard reference for wind power engineers, technicians and manufacturers, as well as researchers and academics involved in this expanding field. Reviews the latest developments in the design, construction and operation of large-scale wind energy systemsOffers detailed coverage of wind resource assessment and siting methods relevant to wind turbine and wind farm planningExplores operation and maintenance issues, such as reliability and maintainability strategies and condition monitoring systems

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Contenido: Cover; Wind energy systems: Optimising design and construction for safe andreliable operation; Copyright; Contents; Contributor contact details; Woodhead Publishing Series in Energy; Part I Fundamental wind energy resources, design, safety and reliability; 1Meteorology and wind resource assessment for wind farm development; 1.1 Introduction; 1.2 Assessment of the wind climate; 1.3 From wind climates to wind resources; 1.4 Wind farm layout; 1.5 Special considerations for offshore wind farms; 1.6 Short-term forecasting; 1.7 Future trends; 1.8 Acknowledgements; 1.9 References 2Site investigation, characterization and assessment for wind turbine design and construction2.1 Introduction to wind energy civil design; 2.2 Wind energy geotechnical investigation; 2.3 Turbine foundations; 2.4 Civil design and micro-siting; 2.5 Sources of further information and advice; 2.6 References; 3Aeroelasticity and structural dynamics of wind turbines; 3.1 Introduction; 3.2 Structural dynamics of wind turbines; 3.3 Aeroelastics of wind turbines under operational conditions; 3.4 Application toward improved aeroelastic design and construction; 3.5 Future trends 3.6 Sources of further information and advice3.7 References; 4Wind turbine wakes and wind farm aerodynamics; 4.1 Introduction; 4.2 One-dimensional momentum theory; 4.3 Blade element momentum theory; 4.4 Computational fluid dynamics modeling of wind turbine rotors; 4.5 Wind farm aerodynamics; 4.6 Simulation of flow and turbulence in wind farms; 4.7 Future trends; 4.8 Sources of further information and advice; 4.9 Acknowledgment; 4.10 References; 5Fatigue loading of wind turbines; 5.1 Introduction and overview; 5.2 Damage model; 5.3 Short-term load distribution; 5.4 Long-term load distribution 5.5 Fatigue life evaluation5.6 Conclusion; 5.7 References; Part II Wind energy system materials, design and component development; 6Aerodynamic design of wind turbine rotors; 6.1 Introduction; 6.2 State of the art; 6.3 Models and elements used in the rotor design process; 6.4 An example of the rotor design process; 6.5 Future trends; 6.6 Sources of further information; 6.7 Acknowledgements; 6.8 Nomenclature; 6.9 References; 7Wind turbine drive train systems; 7.1 Introduction; 7.2 Gearbox and bearing systems; 7.3 Power electronic systems; 7.4 Electrical generator basic characteristics 7.5 Electrical conversion systems7.6 Generation system optimization; 7.7 Conclusion and future trends; 7.8 References; 8Wind turbine control systems and techniques; 8.1 Introduction; 8.2 Instrumentation; 8.3 Control objectives; 8.4 Conventional wind turbine control; 8.5 Advanced control for load reduction; 8.6 Future trends; 8.7 References; 9Wind turbine tower design, erection and maintenance; 9.1 Introduction; 9.2 Lattice towers; 9.3 Tubular towers; 9.4 Load cases on towers for wind turbines; 9.5 Ring-flange connection; 9.6 Periodic monitoring; 9.7 References

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