

Course Information

Aerodynamics and Energy Meteorology for renewable energy conversion

空氣動力和風能氣象學於再生能源轉換之應用

Course Objective: An introduction to the fundamentals of wind meteorology, wind metrology and wind energy conversion is to provide students with the up-to-date concepts of the physical, statistical and meteorological understanding of wind, turbulence and turbines and wind measurement skills essential for success in subsequent course works in renewable wind energy. The student will be able to gain a deeper understanding of the aerodynamics of wind turbines, wind meteorology and metrology for renewable wind energy conversion.

Instructor: Associate Prof. Tzong-Shyng Leu 呂宗行(國立成功大學航空及太空工程系)

Disquisition speakers: Prof. Dr. Joachim Peinke (University Oldenburg, Germany)

Dr. Detlev Heinemann (University Oldenburg, Germany)

Dipl.-Phys. Hendrik Heisselmann (University Oldenburg, Germany)

Dipl.-Phys. Michael Schmidt (University Oldenburg, Germany)

林大惠教授(國立成功大學機械工程系)

余政達教授(國立嘉義大學景觀學系)

吳毓庭教授(國立成功大學工程科學系)

郭玉樹教授(國立成功大學水利工程系)

蔡原祥博士(國家實驗研究院台灣海洋科技研究中心)

苗君易教授(國立成功大學航空及太空工程系)

宣崇堯博士(國立成功大學能源科技與策略研究中心)

李約亨教授(國立成功大學航空及太空工程系)

Textbook: Lecture note will be provided during course.

Reference: Stefan Emei, “Wind Energy Meteorology: Atmospheric Physics for Wind Power Generation”, Spring, 2013 (ISBN 978-3-642-30522-1)

Exercise & Practice: Hand-on exercise and practice will be assigned during course. It will be graded at the end of course.

Exams: One and half hour comprehensive exam will be given during the course.

Grading: Exercise & Practice 50% and Final exam 50%

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Date: 2015, September 7-14 (45 hr lectures)

	Monday (Sep. 7)	Tuesday (Sep. 8)	Wednesday (Sep. 9)	Thursday (Sep. 10)	Friday (Sep. 11)	Monday (Sep. 14)
9:00-10:30	Welcome of students by German and Taiwanese lecturers 林大惠教授 (成大能源科技與策略研究中心主任)	Basics: Aerodynamics of wind turbines I: Introduction the basic phenomena and equations	Basics: Where is the wind blowing? From global wind systems to local wind conditions	Aerodynamics of wind turbines III: Turbulent wind conditions – the instancy of knowing the details of wind, turbines dynamics, and control systems	Basics: Statistics I: standard methods of time series analyses, data corrections, probability density functions, time and space correlations	Wind and solar power production: current state, goals for 2020 and 2030 and ecologic and economic implications in Taiwan (余政達教授 國立嘉義大學景觀學系)
10:30-11:00	Course introduction Coffee break					
11:00-12:30	Introduction of The University of Oldenburg, the Institute of Physics and the Center for Wind Energy Research	Aerodynamics of wind turbines II: Wind turbine as an aerodynamical machine (Betz-rotor model ...)	Numerical solutions of chaos: View over global-, meso- and microscale models, wind and power forecasting	Energy meteorology and grid integration	Statistics II: advanced methods for stochastic modeling of the dynamics of wind turbines	Wind Energy Course Open Discussion Forum
12:30-13:30	Lunch break					
13:30-15:00	Renewable Energies: Past and future	How to measure the wind? Anemometer comparisons	What's the wind now? Outdoor experiment with different anemometers (Lidar, Ultrasonic Wind Sensors etc.)	Exercise: Implementing the sphere anemometer	General aspects of typhoons, estimates of typhoon risks in North West Pacific	Summer school evaluation
15:00-15:30	Coffee break					
15:30-17:00	Wind: Clean and powerful resource for on- and offshore power production	Introduction to the sphere anemometer	(Partially supported Taiwanese lecturers)	Exercise: Sphere anemometer data acquisition and first analyses	Wind turbine design in typhoon affected areas: Challenges and solutions	Course Review: How to go on with common Taiwanese and German research activities?
17:00-17:30	Break					
17:30-19:00	Introduction to the German educational system and living and studying in Germany	Practical demonstration of the sphere anemometer		Practice of wind measurements and data analyses	International Electro-technical Commission (IEC) regulations: Design of typhoon-proved turbines	Introduction to German culture: from Albrecht Dürer to Georg Baselitz, from Johannes Gutenberg to Günther Grass.
19:00-open end	Ice-breaker activity (barbecue or the like)					Farewell with German cooking: beyond Sauerkraut, Beer and Bratwurst.

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Date: 2015, September 21-Oct.26 (9 hr lectures)

11:00-12:30	Monday (Sep. 21)	Monday (Sep. 28)	Monday (Oct. 5)	Monday (Oct. 12)	Monday (Oct. 19)	Monday (Oct. 26)
	Modeling turbine wakes and power losses within a wind farm using LES: An application to the Horns Rev offshore wind farm (吳毓庭教授 成大工科系)	Application of data collected by Met Mast for offshore wind turbine foundation design (郭玉樹教授 成大水利系)	Laser diagnostics of wind turbine blade aerodynamics (李約亨教授 成大航太系)	Wind field measurement and characteristics at Taiwan (蔡原祥博士 國家實驗研究院台灣海洋科技研究中心)	Wind tunnel test of wind turbine and windfarm (苗君易教授 成大航太系)	Lidar measurement Principle and Floating Lidar (宣崇堯博士 成大能源科技與策略研究中心)