Title:	Modelling and Control of Wind Power
Organizer:	Professor, Poul Ejnar Sørensen, DTU Wind Energy, posq@dtu.dk Postdoc, Kaushik Das, DTU Wind Energy, kdas@dtu.dk
ECTS:	5
Schedule:	The course is not following DTU's normal schedule. 19 weeks, 1/04/2018–31/09/2018
Evaluation:	Written report, pass / not pass, internal examiner
Examiner:	Senior Researcher, Anca Daniela Hansen, anca@dtu.dk
Place:	DTU Wind Energy

Scope and form: Introductory lecture / self-study under supervision / discussions with supervisors

Description: The purpose of the course is to obtain knowledge about the dynamic modelling and control of wind power.

General course objectives: This course will give the student a detailed understanding of how to model wind generation systems in MATLAB/Simulink. The models specified in the IEC 61400-27 standard will be used as the starting point. Special focus will be given to the type 4B (full-converter) wind turbine (WT) models, which will be adapted and extended by the student according to the research needs, i.e., electromagnetic transient (EMT) studies of such wind generation systems.

Learning objectives:
The learning objectives of this course are:

- Understand the wind turbine dynamic models detailed in the IEC 61400-27 standard
- Understand the purpose of wind power controls for large and small disturbances
- Implement the type 4B models in MATLAB/Simulink
- Adapt and extend such models for EMT studies (e.g., WT converter controls, PLL/synchronisation, DC link's chopper resistance)
- Describe changes required to modify ~~Change~~ the WT controls from the conventional grid-following paradigm to the grid-forming paradigm
- Conduct EMT studies using the models developed in MATLAB/Simulink

Course literature:

[1] P. Kundur, *Power System Stability and Control*. New York, NY, United States: McGraw-Hill, 1994.
[2] T. Ackermann, Ed., *Wind Power in Power Systems*, 2nd ed. Chichester, United Kingdom: John Wiley & Sons, 2012.
[3] IEC 61400-27-1, "Electrical simulation models – Wind turbines", Geneva, Switzerland, International Standard, Feb. 2015.
[4] K. Das, A. D. Hansen, and P. E. Sørensen, "Understanding IEC standard wind turbine models using SimPowerSystems", Wind Engineering, vol. 40, no. 3, pp. 212–227, Jun. 2016.
[5] O. Anaya-Lara, N. Jenkins, J. Ekanayake, P. Cartwright, and M. Hughes, *Wind Energy Generation: Modelling and Control*. Chichester, United Kingdom: John Wiley & Sons, 2009.
[6] R. M. Blasco-Giménez, S. C. Añó-Villalba, J. Rodríguez-D'Derlée, S. I. Bernal-Pérez, and F. Morant-Anglada, "Diode-Based HVdc Link for the Connection of Large Offshore Wind Farms", IEEE Transactions on Energy Conversion, vol. 26, no. 2, pp. 615–626, Mar. 2011.
[7] Remus Teodorescu, Marco Liserre, Pedro Rodriguez , *Grid Converters for Photovoltaic and Wind Power Systems,* John Wiley & Sons, 2011