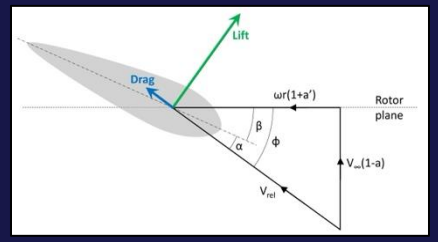
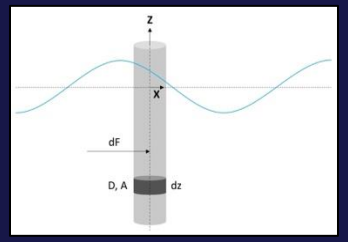
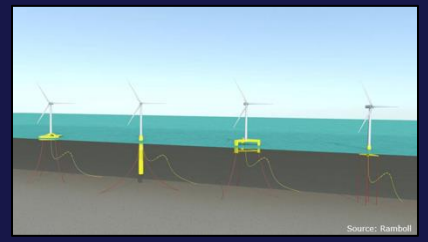
Control of floating wind turbines

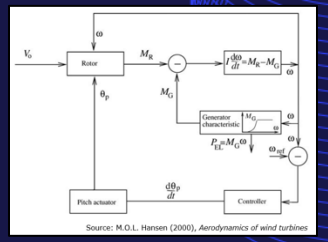
Alan Wai Hou Lio, Sithik Aliyar, Andrew Russell & Henrik Bredmose

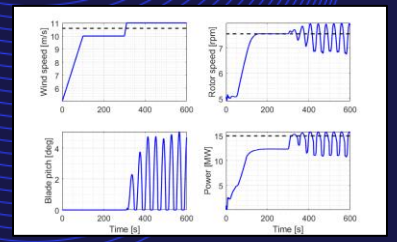
PhD School 19-23 May 2025 (In-person or Online)











Course details

- Organizers:
  - Alan Wai Hou Lio (Associate Professor in wind turbine control)
  - Sithik Aliyar (Postdoc in floating wind turbines)
  - Andrew Russell (Postdoc in wind turbine control)
  - Henrik Bredmose (Professor in floating wind turbines)

- Dates: 19th-23rd May 2025, 9 am to 4 pm

- Address: Technical University of Denmark, Lyngby campus, Anker Engelunds Vej 1, Bygning 101A, 2800 Kongens Lyngby, Denmark

- Points: 2.5 ECTS

Course details

- Participant fee:

	In-person	Online
PhD and MSc students	300 euros	200 euros
Academia	750 euros	500 euros
Industrial participants	3000 euros	2000 euros

  - For on-site participants, the fee covers lunch, coffee and tea during breaks, an icebreaker reception on Monday evening and a dinner on Wednesday evening

Course description

Floating wind turbines can experience instability when operating above rated wind speed, due to the blade pitch controller. This phenomenon, also known as negative aerodynamic damping, is the reason why a wind turbine controller needs to be re-designed for floating wind applications.

But how to pick the best controller settings? The choice of controller parameters has an impact on loads, power production, and stability of floating wind turbines. The first step to tuning a controller is to understand the physics involved.

At DTU Wind and Energy Systems we have organized a PhD Winter School to dive into this problem. Alan Wai Hou Lio (Associate Professor in wind turbine control), Sithik Aliyar (Postdoc in floating wind turbines), Andrew Russell (Postdoc in wind turbine control) and Henrik Bredmose (Professor in floating wind turbines) have prepared a 1-week course that includes an intro to the dynamics of floating wind turbines, an overview of wind turbine control, the famous floater pitch instability, and how to fix it. There will be a combination of lectures and hands-on exercises, where participants will set up a numerical model to investigate the interaction of the floater dynamics with the controller. The hands-on exercises have been designed for MATLAB, therefore we recommend that the participants use MATLAB as well. The course is intended for PhD students and industrial participants with some knowledge on wind turbine response and operation.

Week plan (lecture/exercise/other)

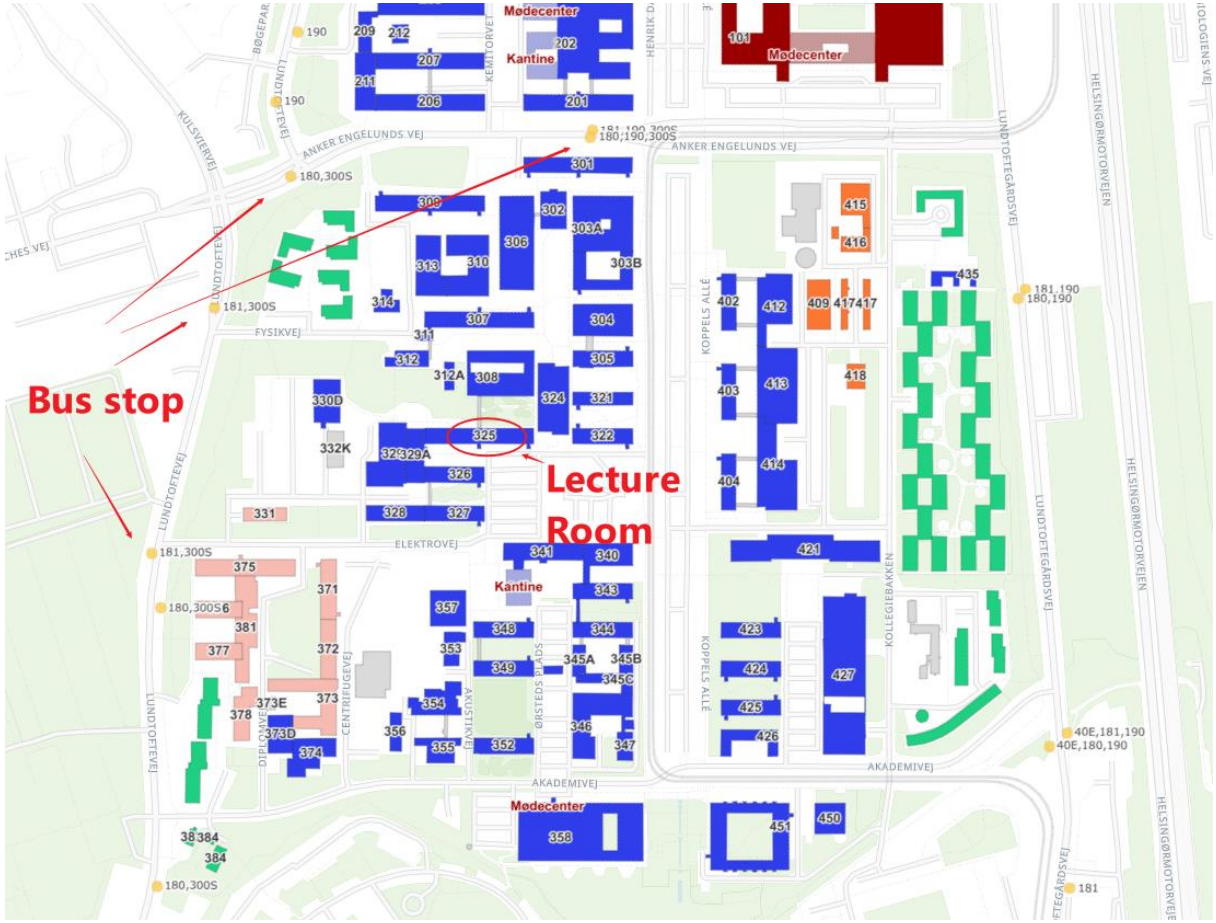
MONDAY 19 May	TUESDAY 20 May	WEDNESDAY 21 May	THURSDAY 22 May	FRIDAY 23 May
• Intro to floating wind turbines • 6 DoF rigid-body response • Wave loads	• Intro to wind turbine control • Generator torque controller • Blade pitch controller • Gain scheduling	• Stability analysis • Interaction between floater and controller • Floater pitch instability	• Avoiding the floater pitch instability • De-tuning method • Tower-top velocity feedback loop	• Industrial guest lecture • Finish model and prepare presentation
L	**U**	**N**	**C**	**H**
• Build 6 DoF response model in MATLAB and calculate response to waves • Ice-breaking reception	• Build 1 DoF blade pitch controller model and test for step wind	• Build 7 DoF coupled model and trigger instability • Social activity and dinner	• Finish the 7 DoF coupled model • Modify your controller to avoid the floater pitch instability	• Group presentations • Feedback session with coffee and cake

DTU Risø campus

- Located in Lynyby, Denmark

[Campus info]

[Interactive map]



How to get to DTU Lyngby campus

By public transport

- From Lyngby station: bus 300S (10 min)
- From Copenhagen Central station: S-train line A or line E to Lyngby station and bus 300S (approx. 45 min)
- From Copenhagen airport: Metro M2 to Nørreport station, S-train line A or line E to Lyngby station and bus 300S (approx. 1h)
- Plan journeys via Rejseplanen or Google Maps
- The easiest way to pay for public transport is with a Rejsekort

By taxi

- From Lyngby station: approx. 140 DKK (19 EUR)
- From Copenhagen airport: approx. 582 DKK (78 EUR)
- Order taxi by usng Dantaxi app or calling (+45) 4675 7575 or (+45) 3535 3535

Please arrive in due time to check-in and locate the teaching room ☺

Accommodation

- Please reserve your room directly with the hotel of your choice
- Hotels in Copenhagen
- Alternatively, you can do an online search for “bed & breakfast Copenhagen”. There are many good and relatively cheap options in the surroundings

Further info

- The course will have an in-person format (no remote participation).
- The teaching room will be communicated by email once the registration closes (after June 16th). The participants will be granted access to the course material before the course starts
- All participants are required to bring a laptop. The exercises have been designed for MATLAB, therefore using MATLAB is highly recommended


DTU