



Science and
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Scientific Computing



CCP-WSI
a Collaborative Computational Project
in Wave Structure Interaction

Machine Learning for Wave Structure Interaction Training

Dr Wendi Liu

Prof Deborah Greaves

Machine Learning for WSI

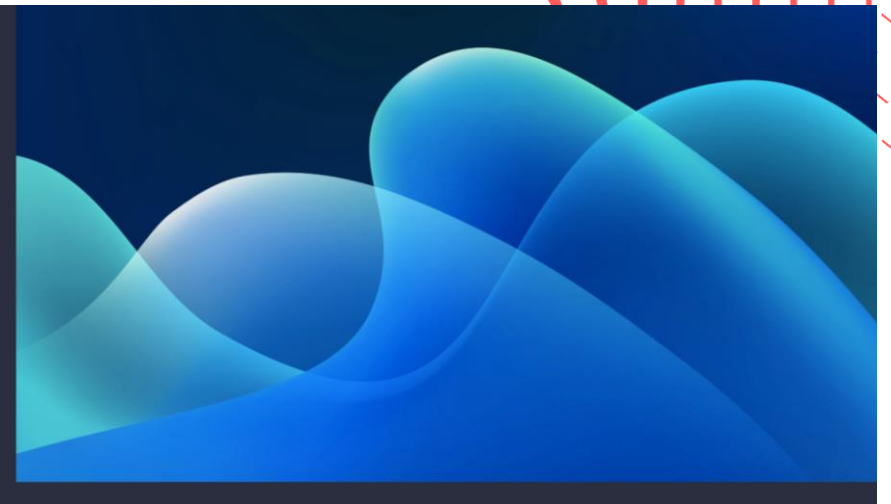
Register

Agenda

📅 4 – 5 Nov 2024

🕒 From 12 on 4th Nov

📍 Hybrid: Brunner-Mond Training Suite, Daresbury Laboratory, Keckwick Lane, WA4 4AD or Online



Introduction to STFC



HM Government



Department for
Science, Innovation
& Technology



UK Research
and Innovation



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Welcome to Daresbury Laboratory

- One of STFC's 6 UK locations
- One of 2 of the UK's national laboratories
- Home to some of STFC's large facilities and associated activities:
 - Computational Science
 - Supercomputing
 - Particle accelerators
 - Engineering for Science
 - Business Incubation

UK Astronomy Technology Centre
Edinburgh, Scotland



Polaris House
Swindon, Wiltshire



Chilbolton Observatory
Stockbridge, Hampshire



Boulby Underground
Laboratory
North Yorkshire



Daresbury Laboratory
Sci-Tech Daresbury Warrington, Cheshire



Rutherford Appleton Laboratory
Harwell Didcot, Oxfordshire



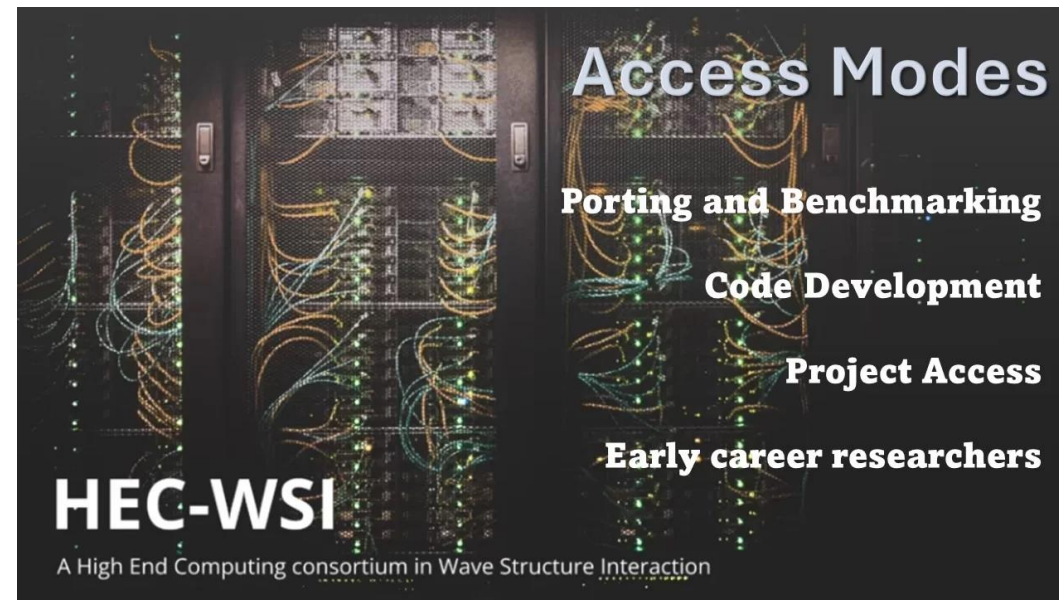
Logistics

- You can get access to the materials of this training from the following repository
<https://github.com/jonycastagna/CCp-WSI-ML-workshop>
- There is no fire alarm expected on either day, so if you do hear one then please exit the building immediately
- If you would like to order a taxi then please book it by the number
 - Apec – 01928 57 57 57
 - Abba – 01925 44 44 44
 - Uber – through your smart phone
- Recommendations of where to get an evening meal:
 - Ring O'Bells – Chester Road
 - The Red Lion – Moore
 - Evenwood Farm – Evenwood Close
 - Stockton Heath/Warrington Town Centre has a number of restaurants

If you need to leave the room at any point, please make sure you take an access card with you (and then bring it back!)

- Collaborative **C**omputational **P**roject on **W**ave **S**tructure **I**nteraction
- Chaired by Plymouth University
- Founded in 2015 and funded by EPSRC until September 2025
- Extended by CoSEC Bridging to October 2026
- Community building around computational methods and related software to solve problems related to WSI
- Directly supported by the STFC CoSeC programme to:
 - Deliver training
 - Implement, release and support software
 - Develop new computational modelling and simulation methods

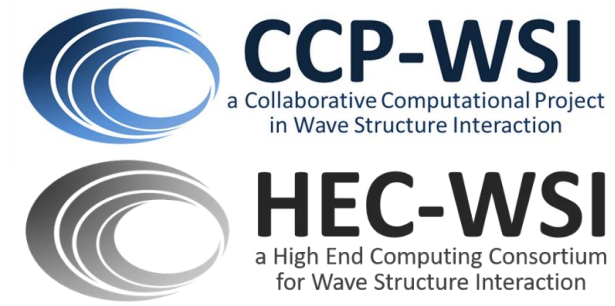
- **H**igh **E**nd **C**onsortia on **W**ave **S**tructure **I**nteraction
- New EPSRC funded community running until December 2026
- Chaired by Plymouth University with the same working group as CCP-WSI
- Provides a simple and single point of entry for UK national supercomputing resources for UKRI funded work related to WSI
- Supported by CoSeC around application performance engineering and training
- Visit the HEC website to apply for access to the ARCHER2 service



PDRA Opportunity

www.ccp-wsi.ac.uk

www.hec-wsi.ac.uk



We expect to advertise shortly for a 24-month post-doctoral research assistant (PDRA) to work across CCP-WSI and HEC-WSI

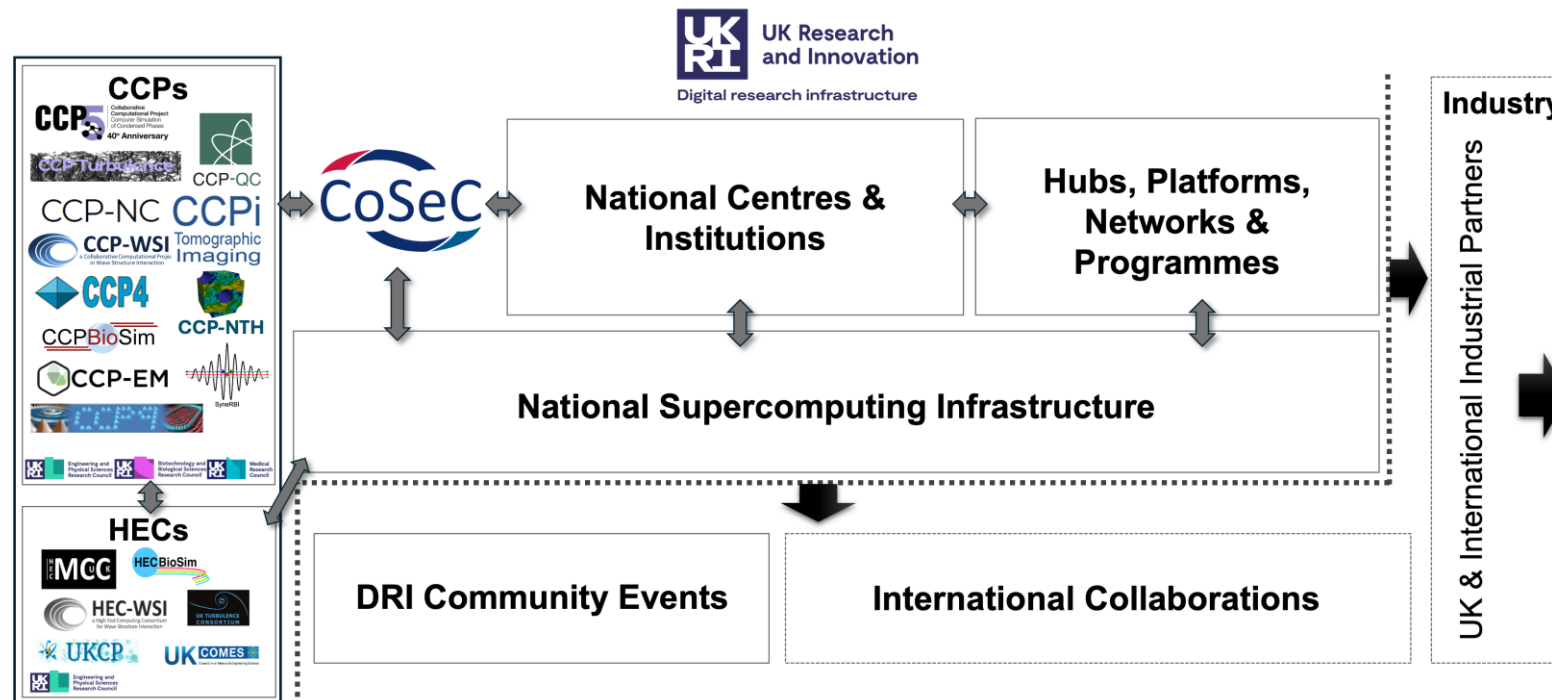
- Development of fully coupled computational fluid dynamics (CFD) and reduced order models for wave structure interaction (WSI) problems
- Development of a fully coupled model of a floating offshore wind turbine (FOWT) with CFD and computational structural mechanics (CSM) solvers through a new modelling framework
- Extension to compound AI approach surrogate model using AI based machine learning approaches and advances made in the project.
- For an informal discussion to find out more about the role then please contact Deborah Greaves by email deborah.greaves@plymouth.ac.uk

CoSeC

www.cosec.stfc.ac.uk



- The **C**omputational **S**cience **C**entre for Research **C**ommunities
- CoSeC is a national Centre
- Across UKRI it provides an interface and point of co-ordination for CCP activity and a bridge for HECs and related DRI components
- A large, stable and diverse team of Research Technical Professionals



Machine Learning for WSI

- The aim of this course is to give an introduction to machine learning (deep learning) and an overview of how different techniques can be applied to CFD problems.
- Through hands-on exercises in computer vision and natural language processing, you'll train deep learning models from scratch, learning tools and tricks to achieve highly accurate results. You'll also see how to leverage freely available, state-of-the-art pre-trained models to save time and get your deep learning application up and running quickly.

Agenda

Day 1 Monday 4 November

12:00 – 12:50	Lunch
12:50 – 13:00	Welcome & Introduction
13:00 – 14:00	Introduction to Deep Learning (NVidia Deep Learning Institute)
14:00 – 15:00	How a Neural Network Trains
15:00 – 15:30	Coffee break
15:30 – 16:30	Convolutional Neural Networks
16:30 – 17:30	Data Augmentation and Deployment

Day 2 Tuesday 5 November

09:00 – 09:45	Pre-trained Model
09:45 – 10:30	Advanced Architectures
10:30 – 11:00	Coffee Break
11:00 – 12:30	Some Literature overview on Deep Learning for Turbulence
12:30 – 13:30	Lunch break
13:30 – 15:00	Test case: StyleGAN as deconvolution operator for LES in BOUT++



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Questions?