Autonomous Biomimetic Robot-fish
for Offshore Wind Farm Inspection

“RoboFish”

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University of York

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EC-OG

PICSEA Ocean Data Automation

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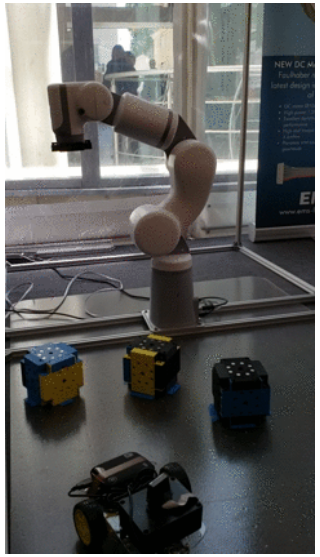
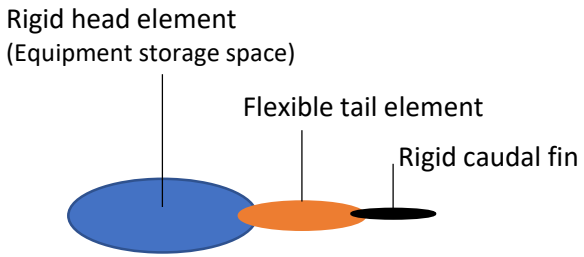
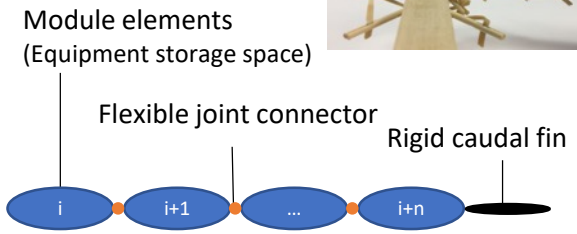
Modular, Self-Aware, and Self-Configuring Autonomous Systems

- RoboFish will build on a self-configuring modular architecture
- Segments will be autonomic cellular elements that operate in unison as a complete “organism” and are fault tolerant

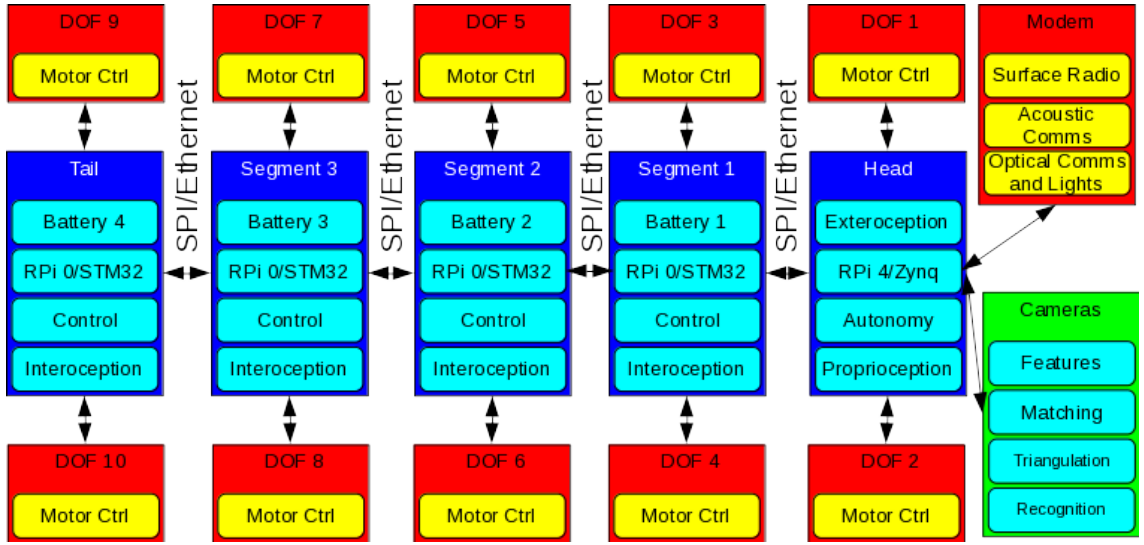




Rigid Head- flexible tail

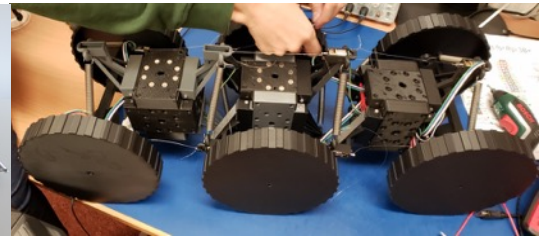


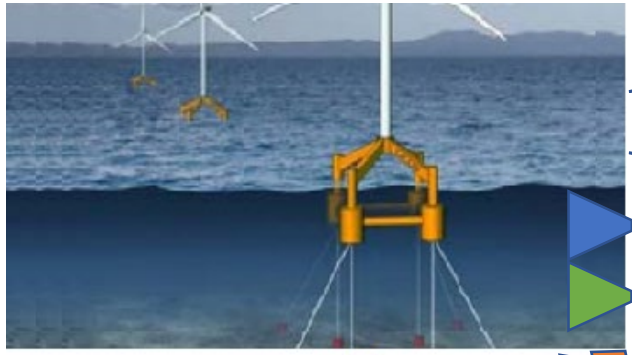
Multi-segment modular architecture

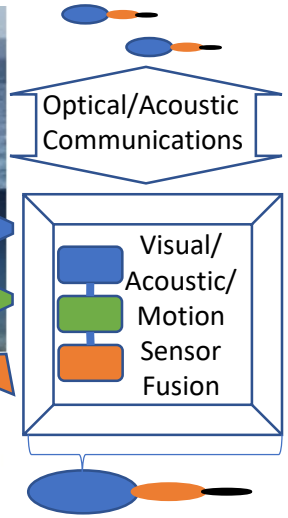


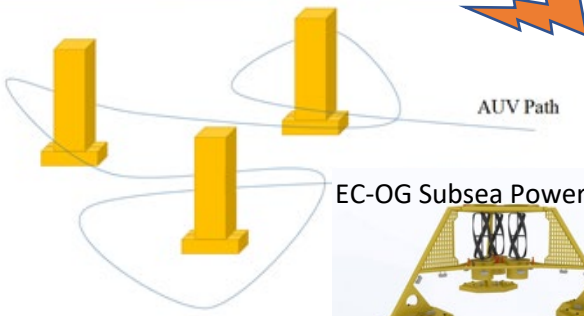
Adaptable, Bio-Inspired, Robust Robots for Harsh Environments

- RoboFish will maneuver and dock using a flexible, adaptable body
- Designs include the use of “biotensegrity” and smart materials









EC-OG Subsea Power Hub

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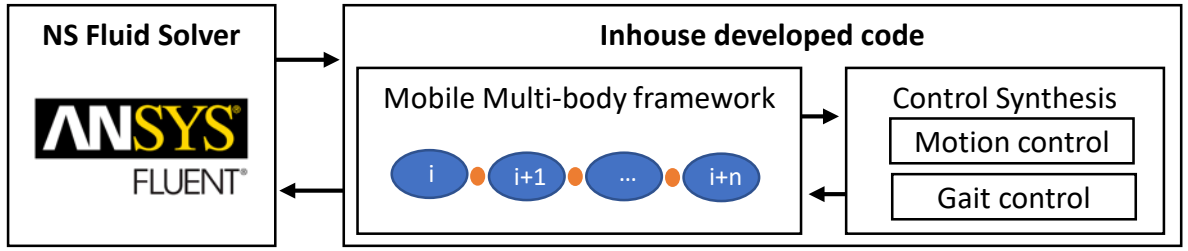
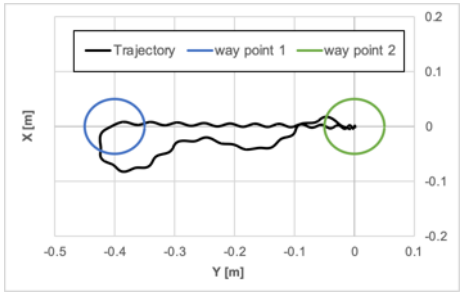
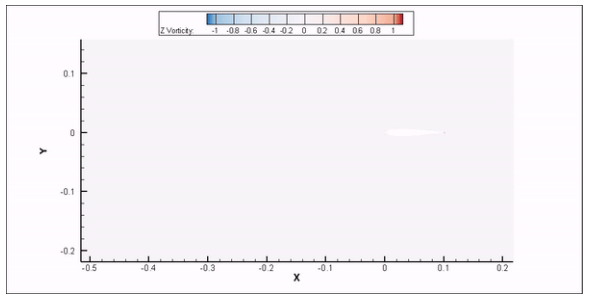
Fully Coupled CFD, Multibody & Control environment: Combined research on hydrodynamic and control of Bio-inspired robotic fish

- Investigation on manoeuvrability and optimal control using numerical Naiver-Stokes solver scheme
- Hydrodynamic investigation and analysis on optimal control strategy, swimming gait and trajectory





Trajectory travelling through 2 waypoints performing a tight turn



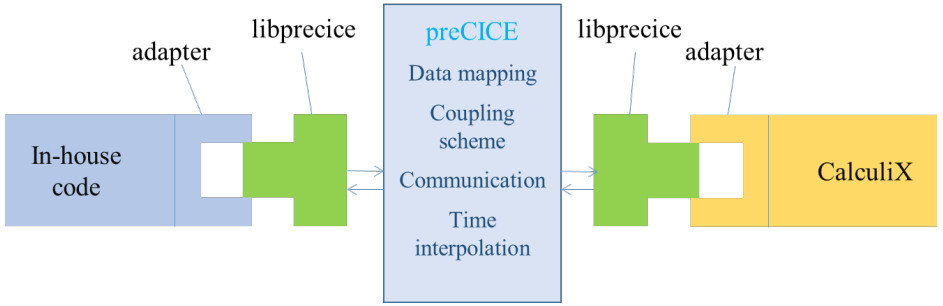
Z-vorticity plot of continuous 5 element NACA0012 performing tight U-Turn

A multi-body dynamics based numerical modelling tool for solving aquatic biomimetic problems, Ruoxin Li, Qing Xiao, Yuanchuan Liu, Jianxin Hu, Lijun Li, Gen Li, Hao Liu, Kainan Hu and Li Wen *Bioinspiration & Biomimetics* (2018) http://iopscience.iop.org/journal/1748-3190

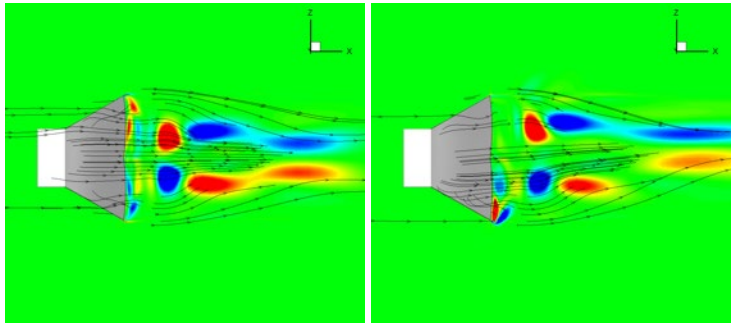
In-house developed CFD code coupled with CalculiX:

Fluid-structure interaction study on flexible fish body and/or fin

- To model large and complex robotic fish model deformations
- Fish structural models: uniform, composite, linear and non-linear
- Sophisticated, robust and multi coupling, super large parallel computation to ensure efficient and stable simulations



Framework of the fully coupled FSI solver



The Y vorticity contour along with streamlines around a caudal-peduncle fin model

Iso-surface of vorticity field (Q criterion) around a caudal-peduncle in model

Luo, Y., Xiao, Q., Shi, G., Wen, L., Pan, G., 2019. A fluid-structure interaction solver for the study on a passively deformed fish fin with non-uniformly distributed stiffness. *Journal of Fluids and Structures.*