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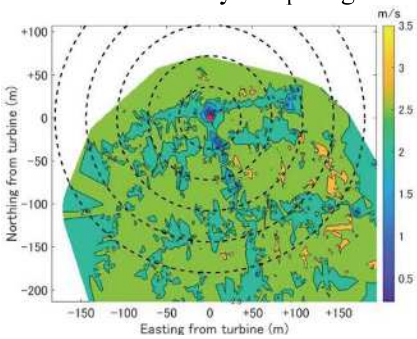
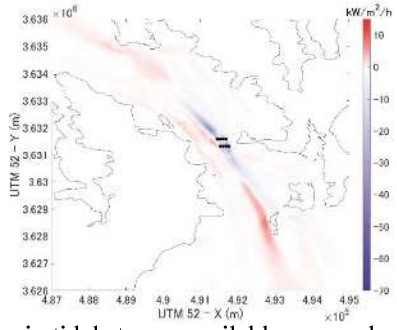
1．主な研究概要

① **Optimization of tidal farms layout**

Tidal energy has two main advantages over other traditional renewable sources: its predictability and its periodicity. However, the Levelized Cost of Energy (LCOE) of this technology is still too high compared with solar PV or wind energy. To reduce this LCOE, we aim to optimize the spatial distribution of tidal turbines in the farm to mitigate wake losses. For this purpose, we use predictions from ocean models that simulate tidal currents and the impact of turbines on the flow. The accuracy of model predictions is confirmed by comparing them with data measured in the field.



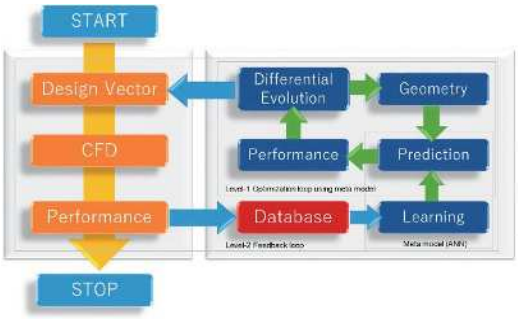
Current velocity measured in the wake of a 0.5 MW tidal turbine



Changes in tidal stream available power density due to a 8-turbines farm in Naru Strait (Ocean model simulation results)

② **Optimization of tidal farms layout**

Another solution to mitigate wake losses in a tidal farm is optimizing the shape of tidal turbine blades to accelerate the wake recovery downstream of the turbine. For this, an optimization system that combines an artificial neural network was combined with a shape search system based on a genetic algorithm to construct a system that can efficiently and automatically search for the optimum shape.



Optimization design system

Horizontal-axis tidal turbine

2．キーワード

和文：潮汐エネルギー、ファームレイアウト最適化、タービン後流、海洋モデリング

英文：Tidal energy, Farm layout optimization, Turbine wake, Ocean modeling

3．特色・研究成果・今後の展望

Resource analysis for the tidal energy demonstration project in Naru Strait

A Collaborative Approach to Model Tidal Stream Turbines to Provide Sustainable Energy Solutions in Scotland and Japan (Strathclyde University)

researchmap：https://researchmap.jp/garcia_novo_patxi

研究室 HP: https://www.mech.nagasaki-u.ac.jp/lab/sakaguchi_lab/html/home.html

4．社会実装への展望・企業へのメッセージ

Tidal energy has two main advantages over other traditional renewable sources: its predictability and its periodicity. Due to these characteristics, tidal energy can facilitate grid management in large grids and reduce the need for energy storage and the usage of backup fossil fuel systems in microgrids of remote islands. For these reasons, the development of tidal energy technologies and projects in Japan is crucial to achieving carbon net-zero objectives.