The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

A Computational Framework for Micro-Swimming: Benchmarks and Applications

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Keywords: *Fluid dynamics, Low Reynolds, Moving Deformable Bodies, Swimming, Feel++, Finite element method.*

Multi-physics toolboxes stemmed from the Finite element embedded library (Feel++[1]), solving electro-mechanics, aerothermal, fluid-structure interaction problems and a few others. A recent extension of the fluid mechanics toolbox allows the simulation of rigid and deformable bodies moving in a fluid [2], using an approach described in [3].

This new "swimmer" toolbox interacts with the fluid mechanics solver via a general interface used to prescribe the velocity and displacement at the interface between the two continua. In the swimmer toolbox, the swimmer's gait can be prescribed using different formulations (imposed position, imposed displacement, imposed velocity), and based on these the remaining quantities are automatically computed.

In this talk, we present the mathematical and computational micro-swimmer framework as well as benchmarking results: moving rigid bodies, and different swimmers that the swimmer toolbox can simulate. Finally, we present an application of reinforcement learning using our framework and selected results.

REFERENCES

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