

Simulation of two interacting squirmers

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1 Context

Our project is part of the ANR project NEMO, Control of Magnetic Micro-swimmers in Complex and Confined Environments. Currently, a team of researchers is developing numerical methods to control a micro-swimmer in the arteries of the human body.

The Squirmer model simulates bacteria with cilia by imposing boundary conditions.

Ultimately, the goal of these robots is to treat cancer cells.

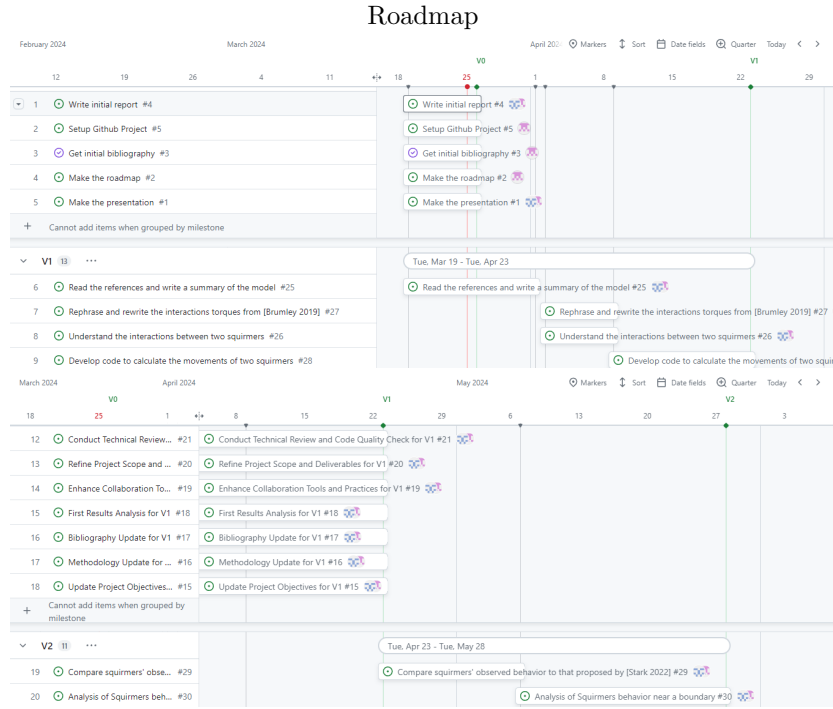
2 Objectives

Our goal is to model the dynamics of two interacting squirmer, influenced by hydrodynamic [?] and collision forces.

We will start by reformulating the formulas of all present forces and torques.[?][?] In addition we will implement this model to realize numerical experiments. The aim of these experiments is:

- Investigating the effects of varying the distance between the squirmers to observe potential modifications in their behaviors.
- To explore the impact of altering the parameter β , which defines the type of squirmers (pusher, puller, neutral), on their interactions.
- To conduct a comparative analysis of the interaction between a squirming micro-robot and a boundary. This analysis will involve varying the initial angle of the the micro-robot, the distance between the swimmer and the wall, as well as the parameter β , to comprehensively understand their influence on the system dynamics.

3 Roadmap



References

- [1] D.R. Brumley and T.J. Pedley. Stability of arrays of bottom-heavy spherical squirmers. *American Physical Society*, 4(053102), 2019.
- [2] Till Welker Holger Stark Miloš Knežević. Collective motion of active particles exhibiting non reciprocal orientational interactions. *Scientific Reports*, 2022.
- [3] Maaß C.C. Théry A. and Lauga E. Hydrodynamic interactions between squirmers near walls: far-field dynamics and near-field cluster stability. *Royal Society Open Science*, 10(230223), 2023.
- [4] Wikipédia. Squirmer. <https://en.wikipedia.org/wiki/Squirmer>, 2022.