

Boundary Effect on Motility in Stokes Flow

L. Giraldi*

UMPA, ENS de Lyon.

Abstract

Swimming, i.e., being able to advance in absence of external forces by performing cyclic shape changes, is particularly demanding at low Reynolds numbers which is the regime of interest for micro-organisms and micro-robots. Since the sixties, experiments have proved that in confined geometries, microorganisms are attracted by the boundaries. Starting from these observations, the question that we want to address is how does boundary affect the motility of micro-swimmers? Our work focuses on swimmers made of several balls linked by thin jacks: the so-called Three-sphere and Four-sphere swimmers. In this talk, we will analyze the effect of a plane wall and a rough wall on the controllability of these particular micro-swimmers.

First, we will recall controllability results got by F. Alouges, A. DeSimone, L. Heltai, A. Lefevbre and B. Merlet in [1] for these swimmers in the whole space. Then, we will analyze the effect of the presence of a plane wall on the controllability of these swimmers (see [2]). Finally, we will generalize our previous study by considering a rough wall (see [3]).

We will show that boundary (plane wall and rough wall) does not affect the controllability of a controllable swimmer. On the contrary, we will prove that the presence of border increases the reachable set of a non fully controllable swimmer.

References

- [1] F. Alouges, A. Desimone, L. Heltai, A. Lefebvre-Lepot and B. Merlet. *Optimally swimming stokesian robots.*, Discrete and Continuous Dynamical Systems Series B, 18(5), 2013.
- [2] F. Alouges and L. Giraldi. *Enhanced controllability of low Reynolds number swimmers in the presence of a wall.* Acta Applicandae Mathematicae, April 2013.
- [3] D. Gérard-Varet and L. Giraldi. *Rough wall effect on micro-swimmers.* Preprint hal-00867599, submitted.

*46 alle d'Italie, 69364 Lyon cedex 07, France. e-mail: laetitia.giraldi@ens-lyon.fr