Passive particle spatial distribution can be controlled by modifying active particle boundary scattering

Stephen Williams

January 25, 2024

1 Introduction

For microswimmers navigating their natural environments, it is common that they will encounter passive structures. These interactions, depending on properties of the swimmer, lead to fundamentally different behaviours. Some key examples of this include ... Choose 3 examples of this and references each: sperm/duct obviously, ideally something with microswimmer-free passive particle, and one with both (vibrio might actually be a nice example of this). One key reasons for these differences lie in swimmer-boundary interactions. It has been previously shown that the interactions of microswimmers with surfaces is dominated by ciliary contact events [kantsler 2013]. To attempt to capture the dynamics of these systems, a vast number of models have been proposed. In [shape matters paper], an extensive outline of the existing models, experiments and theory is outlined. These models generally comprise of a number of desirable features needed to capture the dynamics of microswimmers near to a boundary. In particular: random microswimmer motion, hydrodynamic interactions, and steric interactions both between each other and any boundaries. In this paper, we will focus on swimmers which are composed of a fore-aft asymmetric ensemble of self propelled Particles (SPPs), following previous works by [lowens, kantsler].

2 Active forces and torques

WCA potential

$$U = 4\epsilon \left(\frac{\sigma}{r}^{1} 2 - \frac{\sigma}{r}^{6} \right) \tag{1}$$

Derivative in r

$$U = 4\epsilon \left(\frac{\sigma}{r}^{1} 2 - \frac{\sigma}{r}^{6} \right) \tag{2}$$