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Qualitative Behaviour of the Dynamics of Micro-swimmers in a Linear Flow

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Abstract

This work aims to qualitatively study the dynamics of spherical micro-swimmers under the effect of an external force in a low Reynolds number linear flow [1]. Micro-swimmers naturally reorient themselves, taking into account the complexity of their interactions with the fluid, which results in two types of movement: run and tumble [2,3]. To effectively predict the orientation of a micro-swimmer, depending on the type of motion, our research focuses on determining the hyperbolic and non-hyperbolic equilibrium points of the governing ordinary differential equations for a particle's orientation [4,5]

$$\frac{d\boldsymbol{p}}{dt} = \frac{1}{2}(\boldsymbol{\omega} \wedge \boldsymbol{p} + \lambda(\boldsymbol{j}^* - \boldsymbol{j}^* \cdot \boldsymbol{p}\,\boldsymbol{p}))\,,$$

and examining their stability.

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