Computational Math Seminar

Swimming bacteria: Mathematical modelling and applications

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Abstract: Miniaturisation of actuators and power sources are two of the biggest technical challenges in the design and fabrication of microscopic robots. As it is often the case, Nature can offer insight into overcoming some of these challenges. Swimming bacteria, such as the well-studied flagellated E. coli, are known to be efficient swimmers with intricate sensing capabilities. They have thus inspired scientists to mimic them to improve the design of artificial micro-robots, often with biomedical purposes such as targeted drug delivery.
This talk will consist of two parts. After a brief introduction to the study of swimming bacteria I will review the random walk model for bacterial diffusion and chemotaxis, and will show how to use it to describe the diffusive behaviour of artificial micro-swimmers propelled by swimming bacteria. In the second part of the talk I will address the problem of non-flagellated swimming bacteria. Specifically, we will study a minimal model to describe the dynamics of Smeliferum, a helical bacterium that swims by progressively changing the handedness of its body.

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