Master's Project:

3D-printed macroscopic agent reproducing bacterium behavior

Introduction:

Some bacteria, like *E. Coli* (see Fig. 1), swim in straight runs interrupted by sudden reorientation events called tumbles. At high density, the random changes in the direction of motion cause interesting phenomena, for example, coarsening and clustering, collective translation and/or rotation; but, can we develop a mechanical analogous of these bacteria that is capable to reproduce those behaviours in the macroscopic world?

The first attempt of developing such objects is shown in Fig. 2. This device, called macro-bacterium, is capable to convert vibrational energy into translational and occasionally into rotational energy, by means of friction, but still is not completely clear whether it reproduces or not the above mentioned behaviours.

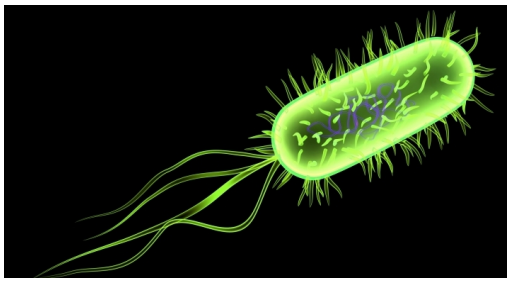

Figure 1: *Escherichia Coli* cell

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Project:

- Designing and printing macro-bacteria in 3D, using rapid prototyping techniques. (You can create your own models)
- Characterization of the motion of the manufactured devices: Using a high speed camera their motion will be recorded for different vibration frequencies and amplitudes, and applying image processing methods physical magnitudes will be determined.
- Performing experiments in order to study the collective behaviour at different densities.
- Optimization of the 3D models.

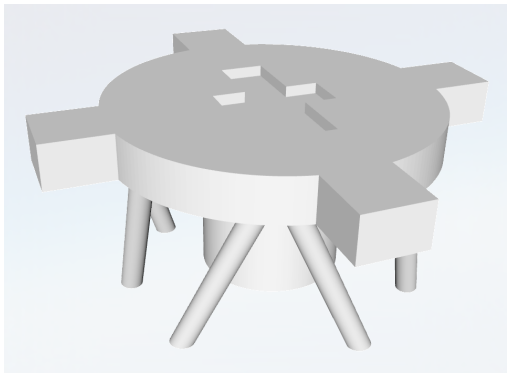

Figure 2: 3D model of a macro-bacterium

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What you will learn:

Modelling and printing in 3D. High speed movie recording techniques. Image processing.

Necessary skills:

You are diligent, have interest for the research. It would be beneficial to have some knowledge in computer programming (Matlab/C++/Java/...), but it is not essential.

Contact information:

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