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Selective control for helical microswimmers PANAYIOTA KATSAMBA, ERIC LAUGA, University of Cambridge — One of the greatest aspirations for artificial microswimmers is their application in non-invasive medicine. For any practical use, adequate mechanisms enabling control of multiple artificial swimmers is of paramount importance. Here we propose a multi-helical, freely-jointed motor as a novel selective control mechanism. We show that the nonlinear step-out behavior of a magnetized helix driven by a rotating magnetic field can be exploited, when used in conjunction with other helices, to obtain a velocity profile that is non-negligible only within a chosen interval of operating frequencies. Specifically, the force balance between the competing opposite-handed helices is tuned to give no net motion at low frequencies while in the middle frequency range, the swimming velocity increases monotonically with the driving frequency if two opposite helices are used, thereby allowing speed adjustment by varying the driving frequency. We illustrate this idea in detail on a two-helix system, and demonstrate how to generalize to N helices, both numerically and theoretically. We finish by explaining how to solve the inverse problem and design an artificial swimmer with an arbitrarily-complex velocity vs. frequency relationship.

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