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Microscale swimming through heterogeneous networks HENRY FU, MEHDI JABBARZADEH, University of Nevada, Reno, YUNKYONG HYON, National Institute for Mathematical Sciences, South Korea — Although there have been many investigations of how swimming microorganisms are affected by complex media which treat the medium as a homogeneous material represented by a continuum constitutive equation, in many cases biological environments have microstructure at similar lengthscales as microorganisms. In that case continuum approaches are not valid and the microstructure and swimmer must be treated on equal footing. For example, cervical mucus contains a network of mucin filaments with a mesh size that can vary from approximately 0.5 to 30 microns, in the same size range as sperm. I will present results which investigate a simple theoretical model of a swimmer moving near similar-size obstructions. First, spherical obstructions are used to deduce physical principles linking the swimmer flow field, forces on obstructions, and changes in swimming velocities. Then single rod-like obstructions are studied which are similar to the filaments of networks. Using these results, we deduce the effect of a network of filaments. Notably, swimming properties such as the change in swimming speed and variance of the swimming speed reflect the density and orientation correlations of the microstructure, and hence swimming properties can be used as probes of microstructure.

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