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An algorithm for low to moderate Reynolds number swimming OSCAR M. CURET, NEELESH A. PATANKAR, MALCOLM A. MACIVER, Department of Mechanical Engineering, Northwestern University — A number of organisms in nature swim by active undulations or deformations of their bodies, fins or flagella. Swimming mechanisms employed by these organisms are inspiring basic science research as well as novel applications in bio– and nano–technology. Here, we develop a numerical scheme capable of fully resolving the swimming motion of an organism as a result of its prescribed deformations. The numerical solution at a given time proceeds in two steps. In the first step we solve the Navier-Stokes equations in the entire fluid-organism domain. In the next step, the fluid velocity in the organism domain is corrected by a "momentum redistribution" scheme. This imposes the prescribed deforming velocity in the frame of reference of the organism. These steps are iterated until convergence. The resulting solution gives the swimming velocity of the organism and the surrounding flow field. A variety of body forms can be set up by this approach including 3D bodies with 2D fins or 1D flagella attached to it. It is suitable at low to moderate Reynolds (Re) numbers. Since it is an iterative implicit approach, it can be easily applied to 'zero' Re swimmers. We will present some examples as well as validation of the numerical scheme. The approach is also applicable to problems like the self-organization of cellular organelles or designing swimming micro robots.

Oscar Curet
Northwestern University

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