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Squirmer in a density-stratified fluid VASEEM SHAIK, AREZOO ARDEKANI, Purdue University — In this work, we analyze the motion of a two-mode spherical squirmer in a linearly density stratified fluid using the method of matched asymptotic expansions. We assume that the quasi-steady conditions prevail, inertia is negligible, stratification and advective transport rate of density are small, and the swimmer is oriented either vertically upwards or downwards. We consider a swimmer that is either far away from its neutrally buoyant position (NBP) or close to its NBP. Using the Boussinesq approximation, we find that stratification reduces the speed of a swimmer that is far from its NBP irrespective of the swimming gait while the stratification reduces (resp. increases) the speed of a pusher (resp. puller) swimmer that is close to its NBP. We can understand the former observation by considering a settling rigid sphere in a stratified fluid whereas the latter observation is consistent with the reported direct numerical simulations. Close to the swimmer, the flow field is approximately the same in the homogeneous and the stratified fluid but far from the swimmer, the flow field in these two fluids is significantly different. We also comment on the power consumption and the swimming efficiency in a stratified fluid.

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