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Swimming sheet in a density stratified fluid RAJAT DANDEKAR, VASEEM SHAIK, AREZOO ARDEKANI, Purdue University — In this work, we theoretically investigate the swimming velocity of a Taylor swimming sheet immersed in a linearly density stratified fluid. We use a regular perturbation expansion approach to calculate the swimming velocity up to second order in wave amplitude. We use our results to understand the effect of stratification on the swimming behavior of organisms. Our study finds a direct application for swimmers in oceanic waters, where stratification occurs naturally either due to gradients in temperature or salinity. We divide our analysis in two regimes of low and high Reynolds numbers. We find that stratification significantly alters the flow field around the swimmer. This has a direct consequence on the motility characteristics of the swimmer such as swimming velocity, power expenditure, hydrodynamic efficiency and the induced mixing by the swimmer. We explore this dependence in detail for both the regimes of Reynolds number and elucidate the fundamental insights obtained. We expect our work to shed some light on the importance of stratification in the locomotion of organisms living in such environments.

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