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Symmetry breaking in gastropod locomotion through acceleration or deceleration of the pedal waves JUAN C. DEL ALAMO[1], JAVIER RODRIGUEZ-RODRIGUEZ, JANICE LAI, ROBERT D. SHEPHERD, JUAN C. LASHERAS, University of California San Diego — Marine and terrestrial gastropods move by gliding over a ventral foot that is lubricated by secreted mucus (terrestrial) or simply by water (marine). The rim of the ventral foot generates suction forces that keep the animal adhered to the substrate. The central part of the foot produces a forward traction force by generating trains of pedal waves through periodic muscle contractions. Recent experiments show that, in some gastropods, these pedal waves become faster and longer as they move forward, suggesting a mechanism for breaking the symmetry in the flow between the pedal waves and the substrate. To investigate this mechanism, we have analyzed theoretically a two-dimensional lubrication layer between a train of waves of slowly varying length and speed, and a flat, rigid, impermeable surface. The inhomogeneity of the pedal waves has been modeled through multiple-scale asymptotics. We have considered a Newtonian fluid to separate the effect of this inhomogeneity from the viscoelastic symmetry breaking reported in previous works.

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