Abstract Submitted
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An analytical approach to fluid ratcheting in oscillatory boundary layer[1] JIE YU, Civil, Construction and Environmental Engineering, North Carolina State University — It is well known that oscillatory flows close to a rigid or flexible boundary induces a steady streaming due to viscosity. Under progressive motions, this becomes a unidirectional streaming near the boundary (e.g. mass transport or peristaltic pumping in water waves). This mechanism is shared by the phenomenon of ratcheting fluid in a narrow channel by vibrating the channel walls that are lined with asymmetric corrugations (shown by a recent experiment BAPS.2010.DFD.HC.3). A theory is presented here to describe the ratcheting effects in such a channel. A conformal transformation method, developed for waves over arbitrary periodic topographies (Yu & Howard, *J. Fluid Mech.* 2012), is adapted to deal with large corrugations of the channel walls. Under the assumption that the wall oscillations are of small amplitude, the vorticity dynamics can be analyzed in the mapped plane, obtaining the solution that describes the steady streaming field due to nonlinear convective inertia. The results are discussed, regarding the dependency of the pumping direction on the oscillation frequency of the walls and the effects of the end position relative to the phase of corrugations in the case of a finite length channel. Preliminary experimental data will be presented if time permits.

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