## Abstract Submitted for the DFD15 Meeting of The American Physical Society

On the dynamics of flexible blades in oscillatory flows MITUL LUHAR, University of Southern California, HEIDI NEPF, Massachusetts Institute of Technology — We present an experimental and numerical study that describes the motion of flexible blades, scaled to be dynamically similar to natural aquatic plants, forced by wave-induced oscillatory flows. For the conditions tested, blade motion is governed primarily by two dimensionless variables: the Cauchy number, Ca, which represents the ratio of the hydrodynamic forcing to the restoring force due to blade stiffness, and the ratio of the blade length to the wave orbital excursion, L. For flexible blades with Ca >> 1, the relationship between drag and velocity can be described by two different scaling laws. For large excursions  $(L \ll 1)$ , the flow resembles a unidirectional current and the scaling laws developed for steady-flow reconfiguration studies hold. For small excursions (L >> 1), the beam equations may be linearized and a different scaling law for drag applies. The numerical model employs the Morison force formulation, and adequately reproduces the experimentally measured forces and blade postures. In some cases with  $Ca \sim O(1)$ , the measured forces generated by the flexible blades exceed those generated by rigid blades. Observations of blade motion suggest that this behavior is related to an unsteady vortex shedding event, which the quasi-steady numerical model cannot reproduce.

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