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Energy extraction from flexible slender bodies KIRAN SINGH, SEBASTIEN MICHELIN, EMMANUEL DE LANGRE, LadHyX, Ecole Polytechnique, Palaiseau, France — Long slender structures such as underwater cables may develop instabilities that can lead to large amplitude oscillations, chaotic behaviour invariably leading to failure. Whilst the norm is to avoid such regimes, here we examine the converse problem of energy extraction from flexible slender bodies in a fluid. We derive the terms for this fluid-structure interaction problem paying specific attention to large-amplitude deflections in the small curvature limit. We use a local approach to model inviscid and viscous fluid dynamic contributions. We represent the structure as a bi-articulated cylindrical pendulum with stiffness and structural damping introduced discretely at the joints; the simple system thus has two degrees of freedom, (θ_1, θ_2) with fixed-free boundary conditions. We solve the coupled system of second order in time non-linear ODEs and examine the response of this fourth order system, $\mathbf{Y} = \{\theta_1, \theta_2, \dot{\theta}_1, \dot{\theta}_2\}^T$. A key objective of this work is to examine the feasibility of energy extraction from such systems, represented by the structural damping term. In order to examine the parameter space for likely solutions, we quantify the associated energies and examine the related problem of stability. In particular, we are interested in seeking stable limit-cycle oscillations. Time permitting, we consider the flexible slender body response for specific cases.

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