The aerodynamics of jumping rope

JEFFREY ARISTOFF, HOWARD STONE, Department of Mechanical and Aerospace Engineering, Princeton University — We present the results of a combined theoretical and experimental investigation of the motion of a rotating string that is held at both ends (i.e. a jump rope). In particular, we determine how the surrounding fluid affects the shape of the string at high Reynolds numbers: the string bends toward the axis of rotation, thereby reducing its total drag. We derive a pair of coupled non-linear differential equations that describe the shape, the numerical solution of which compares well with asymptotic approximations and experiments. Implications for successful skipping will be discussed.