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INFLUENCE OF THE ANGLE OF ATACK ON PROPULSIVE EFFICIENCY OF OSCILLATING FOILS

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In the paper it was presented the numerical results related to the oscillating foils in uniform stream of fluid. From the point of view of fluid mechanics we know that the aerodynamics forces generated on the profile are determined by the dynamics and distribution of vorticity around the body. The mechanisms of aerodynamic forces generation by birds and insects go from the heaving and pitching motion of wings. Shedding vorticity from the body and its interaction with the wake determine the propulsive efficiency, defined as the ratio of useful power over input power. The essential dimensionless parameter that describes the foil kinematics are Strouhal number $St = fh_0/U$, the heave amplitude -to-chord ratio $h^* = h_0/c$, the pitch amplitude $\theta(t)$, and maximum nominal angle of attack α (see figure 1.)

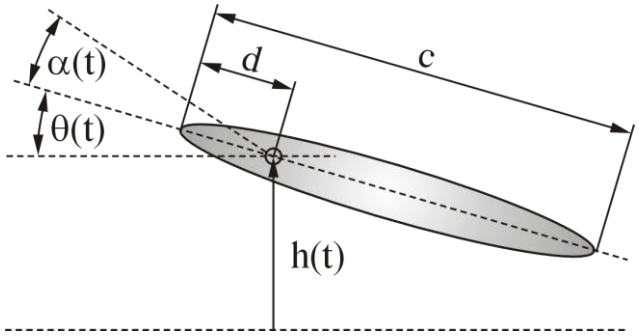

Figure 1. Definition of parameters: heave $h(t)$, pitch $\theta(t)$, nominal angle of attack $\alpha(t)$.

All enumerate parameters have influence on the vortex wake and vorticity distribution around the body. The properties of the vortex wake decides on the magnitude and direction of the lift and thrust force. In this paper we investigate the influence of the maximum nominal angle of attack on type of the vortex street behind the body and the influence of the α on the propulsive efficiency. It was investigated also the influence of the Reynolds number $Re = Uc/\nu$ up to 1000. Such small Reynolds number is characteristic for fly of the small insects. We built the phase diagram that describes the dependence of the different vortex street from the α and Strouhal number. As a numerical method we choose the vortex particle method that is very efficient for the study the phenomena governed by the vorticity distribution.

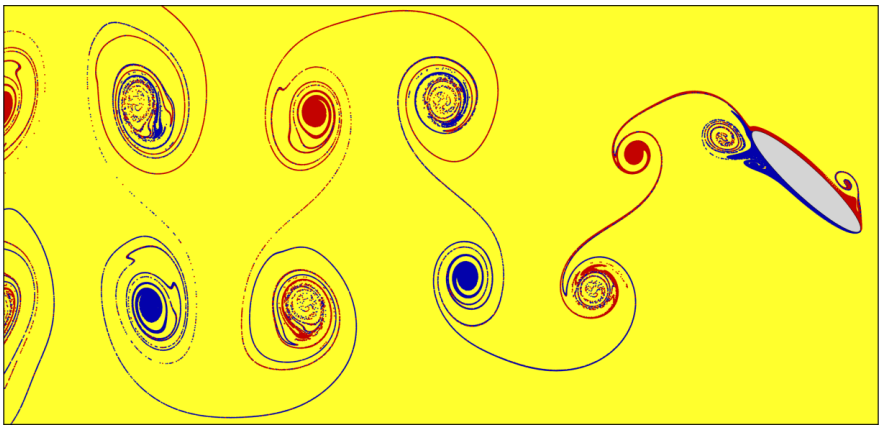

Figure 2: The wake behind the oscillating foil of 2P type; *Re = 750* , *St* = 0.5, *h* = 1*. The 2P means that two vortex pairs with opposite circulation are shed per oscillation period.

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