Numerical study of the flow around a set of two flat plates at different angles of incidence*

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The hydrodynamic interaction between airfoils or blades arranged in a given configuration, and, particularly, the effect that the wake behind an airfoil has on the lift of the following one in the array, is a relevant problem in many engineering applications. In this work we consider this problem for an array of just two flat plates with a configuration of interest in some non-rotary tidal currents converters consisting of an array of blades or sails which is set into motion by the current in a given direction.[1]

In particular, we consider here the three-dimensional turbulent flow around a set of two flat plates with the configuration sketched in the inset of Figure 1, for different angles of attack α, with the objective of characterizing the optimum angle for which the amount of energy absorbed from the current is a maximum for a given Reynolds number (Re). To that end we have carried out numerical simulations using a k-omega turbulent model whose parameters have been adjusted by fitting the numerical results with published experimental data for a single flat plate.[2]

Figure 1 shows some results for $Re = 8 \times 10^4$. The drag (C_D) and lift (C_L) coefficients for each flat plate are shown as functions of α. Also included is the comparison of the numerical results for a single plate with the experimental results by Pelletier and Mueller (2000)[2]. It is of interest to note that C_L for the front plate is larger than that for a single plate if α is high enough. For each Re we optimize the value of α for which the total work exerted by the current on the two plates in the appropriate direction of the tidal energy converter is a maximum.

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[2]Pelletier, A. and Mueller, T.J., *Journal of Aircraft* **825–832**, 37 (2000).

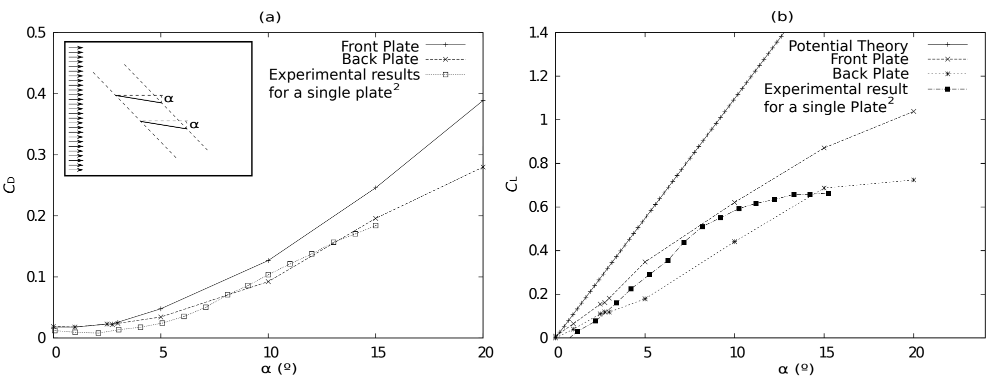

Figure 1: C_D (a) and C_L (b) as functions of α for $Re = 8 \times 10^4$.