Experimental study of the aerodynamic characteristics of a low-aspect-ratio flat plates array in a configuration of interest for a tidal energy converter.

F. Fedoul, L. Parras, C. del Pino and R. Fernandez-Feria

E. T. S. Ingeniería Industrial, Universidad de Málaga, Dr Ortiz Ramos s/n, 29071 Málaga, Spain

Abstract

Wind tunnel experiments were conducted for the flow around a single flat plate and through an array of three parallel flat plates at different angles of incidence to compare their lift and drag coefficients for several values of the Reynolds number around 10^5 and for three aspect ratio values. The selected cascade configuration is of interest for a particular type of tidal hydrokinetic energy converter. The main differences in the lift and drag forces are discussed, finding that for a plate in a cascade the maximum lift coefficient takes place at a quite different angle of attack, depending on the aspect ratio. The optimal conditions for extracting power from a tidal current are analyzed.

1. Introduction

The study of the flow through cascades (or lattices of airfoils) is of great practical interest for the aerodynamics of turbines and compressors, and much theoretical and experimental efforts were made, mainly during the developing of the axial turbines and compressors along the first half of the 20th Century, to characterize the aerodynamic forces exerted on the blades of a cascade (see, e.g., Hawthorne, 1964). As a consequence, a large amount of experimental data for the aerodynamic characteristics of very different types of cascades, many of them obtained in specially designed wind tunnels, have been accumulated over the years, both for low speed (incompressible) and high speed (compressible) flows (see, e.g. Gostelow (1984, Chapters 2 and