

Determination of the drag coefficient of an autonomous solar lighting column using wind tunnel simulation and computational analysis

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Abstract

The Sun is the largest source of energy available and many studies for the development of technologies capable of harnessing this energy are constantly being conducted. Among the technologies developed are photovoltaic solar panels that have many applications and among them are the autonomous solar lighting columns that have been growing in popularity especially in urban and industrial environments. These columns are installed in open regions and have their structure exposed to the mechanical actions imposed by the wind, so they need to be correctly designed to support them. There are aerodynamic variables that must be determined for the design of these columns, especially the drag coefficient, a property linked to the geometry of a body, which represents its interaction with a flowing fluid. Due to the complexity of determining these variables, experimental methods are constantly used to obtain these values. Classically, wind tunnel simulations are used for this purpose, but they can be expensive and difficult to perform. Fluid dynamic computational analysis has been widely applied to replace physical analysis. In this work, the drag coefficient of an autonomous solar lighting column is determined by wind tunnel simulations and computational analysis. With the obtained results, a comparison is made to verify the fidelity of the data obtained by computational means when compared to those obtained through the wind tunnel simulations.

Keywords

Drag coefficient, Wind tunnel simulations, Computational Fluid Dynamic analysis, Autonomous solar lighting columns