

Accepted Manuscript

Reduction of Fluid Forces Acting on a Square Prism Using a Planar Jet

Yahya Erkan Akansu, Erhan Fırat, Mustafa Hacıaloğulları

PII: S0894-1777(17)30094-8
DOI: <http://dx.doi.org/10.1016/j.expthermflusci.2017.03.031>
Reference: ETF 9061

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 4 September 2016
Revised Date: 11 March 2017
Accepted Date: 13 March 2017

Please cite this article as: Y.E. Akansu, E. Fırat, M. Hacıaloğulları, Reduction of Fluid Forces Acting on a Square Prism Using a Planar Jet, *Experimental Thermal and Fluid Science* (2017), doi: <http://dx.doi.org/10.1016/j.expthermflusci.2017.03.031>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Reduction of Fluid Forces Acting on a Square Prism Using a Planar Jet

Yahya Erkan Akansu^a, Erhan Fırat^{b,*}, Mustafa Hacıoğulları^a

^aDepartment of Mechanical Engineering, Ömer Halisdemir University, TR 51240, Niğde,
Turkey

^bDepartment of Mechanical Engineering, Munzur University, TR 62000, Tunceli, Turkey

*Corresponding author. Tel: +905555104149; fax: +904282131861

E-mail addresses: akansu@ohu.edu.tr (Y.E. Akansu), efirat@munzur.edu.tr (E. Fırat).

Abstract

This experimental study focused on the concurrent minimization of the mean and fluctuating forces acting on a square prism in crossflow by creating a continuous jet through a narrow spanwise slot in it. For this purpose, three different predetermined injection surfaces (i.e., front, top, and rear) were individually studied for the injection ratios (IR) of 0, 1, 1.5, 2, 2.5, and 3 at a Reynolds number (Re) of 8000. The results showed that the rear jet is the optimum injection surface. For the rear jet configuration, the optimum IR is 1.5 in terms of mean total drag coefficient reduction, $\langle C_{DT} \rangle$. In this case, the reductions in the $\langle C_{DT} \rangle$ and the level of root mean square (RMS) of fluctuating pressure coefficient ($C_{P_{RMS}}$) on the side surfaces are about 29.7% and 68%, respectively. However, the maximum reduction in the $C_{P_{RMS}}$ level on the side surfaces occurred at $IR = 2$. In this case, the reductions in the $\langle C_{DT} \rangle$ and the level of $C_{P_{RMS}}$ on the side surfaces are about 27.5% and 88%, respectively. The underlying mechanism of force reduction was also demonstrated. Various flow patterns were identified with respect to IR at incidence angle (α) of 0° . It was also proved that, at relatively small angles of incidence, from $\alpha = 0^\circ$ to 20° , the active flow control method is still effective in reducing $\langle C_{DT} \rangle$ and in suppressing the fluctuating side forces, which is indicative of periodic vortex shedding from either side of the square prism.

Keywords: Active flow control; Jet injection; Drag reduction; Square prism; Angle of incidence

Nomenclature

Download English Version:

<https://daneshyari.com/en/article/4992482>

Download Persian Version:

<https://daneshyari.com/article/4992482>

[Daneshyari.com](https://daneshyari.com)