6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

# Numerical Study of laminar flow control for Airfoil Based on Plasma actuators

**ZHAO Ke，DENG Yiju, FENG Haiyong**

The first aircraft institute of AVIC, No.1 East Renmin Road, Yanliang, Xi'an, Shaanxi, China,
zhaokecfd@163.com

**Key Words:** *Plasma Actuators, Laminar Flow Control, Transition, Numerical Simulation*

In this paper, the Numerical simulation method is used to study the control effect of dielectric barrier discharge plasma technology on the transition of the airfoil boundary layer. The phenomenological model is used to simulate the plasma actuators. The potential and charge density field of the plasma actuators are obtained by solving the Poisson equation, resulting in a volume force. The $\gamma - \overline{Re_\theta}$transition model of 4 equations is used to simulate the process of laminar flow transition. The reliability of the plasma technology is verified by the flow past the plate. Finally, the numerical simulation of the laminar flow control of the airfoil boundary layer is carried out. The results show that the plasma technology can delay the airfoil transition point and reduce the drag, and its control effect is directly related to the excitation intensity and distribution of the plasma..

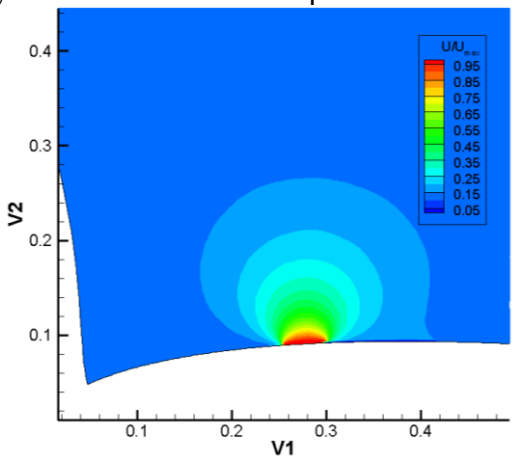


Fig. 1 the potential distribution of the distribution

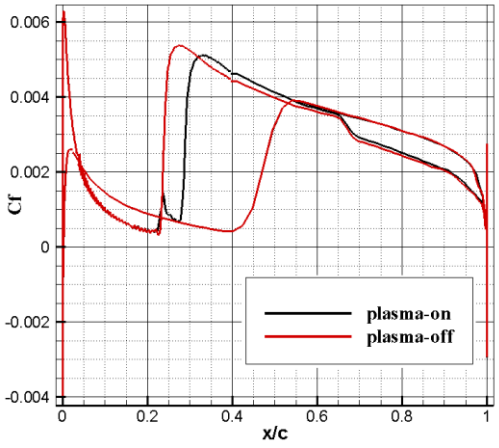


Fig. 2 comparisons of the friction airfoil plasma actuator

The potential distribution airfoil plasma actuator is shown in Figure 1 Figure 2 shows the comparisons of the friction distribution, the figure shows the plasma actuator makes the transition position after the shift of 0.05c, effectively increasing the airfoil laminar flow area,

## REFERENCES

[1] Schrauf G. Status and perspectives of laminar flow [J].The Aeronautical Journal,2005,109(1102):639-644

[2] Corke T C,Enloe C L,Willkinson S P. Dielectric barrier discharge plasma actuators for flow control[J].Annual Review of Fluid Mechanics,2010,42:505-529

[3] Grundmann S，Cameron T. Experimental transition delay using glow-discharge plasma actuators[J]. Experiments in Fluids, 2007, 42(4):653-657