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等离子体激励器对微型飞行器横航向气动力矩控制的实验研究

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Experimental Study of Directional-lateral Aerodynamic Moment Control of Micro Air Vehicle by Plasma Actuators

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摘要

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摘要 在前期等离子体激励器基本流场特性研究的基础上,将等离子体激励器应用于微型飞行器(MAV)进行气动控制。当来流速度为9.1 m/s时,在微型飞行器机翼吸力面非对称布置不同的单介阻挡放电(SDBD)等离子体激励器,通过对未施加激励的偏航、滚转力矩曲线和施加激励的偏航、滚转力矩曲线进行对比,发现横航向气动力矩发生很大的改变,可以实现对横航向气动力矩的控制。在此基础上,采用图像测速(PIV)技术,对机翼背风面的流场进行研究,分析产生横航向控制力矩的流动机理。通过改变激励器的输入电压、占空比和调制频率,实现对横航向气动力矩的比例控制。

关键词: 微型飞行器 等离子体激励器 流动控制 横航向气动力矩 图像测速

Abstract: Base on the existing research of flow field characteristics of plasma actuators, a study is made to apply these actuators to micro air vehicle(MAV) for aerodynamic control. The single dielectric barrier discharge (SDBD) plasma actuators asymmetrically placed on the leeward of the wings of MAVs are found to generate rolling and yawing moments when the flow speed is 9.1 m/s. In addition to force measurement experiment, a flow visualization experiment using particle image velocimetry(PIV)technology is carried out, and the flow control result on leeward is discussed. Base on the above work, the directional-lateral aerodynamic moment control mechanism is analyzed. The ratio control of the rolling and yawing moment is realized through changing the input voltage, duty cycle and frequency of the plasma actuators.

Keywords: micro air vehicle plasma actuator flow control directional-lateral aerodynamic moment particle image velocimetry

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