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水滴撞击特性的数值计算方法研究

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STUDY ON NUMERICAL METHOD FOR DETERMINING THE DROPLET TRAJECTORIES

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摘要 对水滴撞击特性的数值计算方法进行了研究。在对防冰部件流场进行计算的基础上,通过对水滴所在单元的判断和单元内流场速度的插值求解以及水滴运动轨迹计算边界的判断,采用差分法对水滴运动方程进行了数值求解,得到了水滴运动轨迹,从而确定了水滴的撞击极限、总收集系数和局部水收集系数等水滴撞击特性参数,为飞机防冰系统的设计奠定了基础;此外,以发动机进气道的水滴撞击特性的计算为算例,研究了飞行高度、飞行速度及水滴半径对水滴撞击特性的影响。

关键词: 防冰 水滴撞击特性 数值方法 流场 差分

Abstract: Numerical methods for determining the trajectories of the water droplets are studied for anti icing system design. Based on the calculation of flowfield around the icing surface, through judging the droplet location and determining the insert value of flowfield velocity at the droplet location in a given cell and judging the boundary of the droplet trajectories, numerical results of the equations of motion for the droplets are presented by using a difference method, and the droplet trajectories are obtained. Then, the impact range on the inlet surface, the total collection efficiency, and the local collection efficiency are determined. In addition, the droplet trajectories of an engine inlet, as an example, are calculated, and the effects of flight height, flight velocity, and radius of water droplet on droplet trajectories are also investigated. These results show that the numerical method in this paper is effective.

Keywords: anti-icing tra jector ies o f the wat er dro plets numer ical m ethod flow field difference method

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