

航天电子技术

高超声速飞行器等离子鞘套中的电磁波传播

李江挺, 郭立新, 方全杰, 刘伟

西安电子科技大学理学院, 陕西 西安 710071

摘要:

高速飞行器再入时表面形成的等离子鞘套对飞行器的通讯联络、飞行控制产生不可忽略的影响,导致“黑障”现象。采用压力权函数修正的迎风型矢通量分裂格式(modified advection upstream splitting method by introducing the pressure based weight functions, AUSMPW+),求解Navier Stokes方程组,计算了包覆流场中的电子密度及等离子鞘套对电波的衰减,并且根据电磁窗口装置原理图,对非均匀磁化等离子体中的电波传播进行了仿真。结果表明,增强磁场可明显减小磁窗内的电子密度,有效降低等离子体鞘套对电磁波的衰减。

关键词: 等离子体鞘套 压力权函数 迎风型矢通量 电磁窗口

Electromagnetic wave propagation in plasma sheath of hypersonic vehicles

LI Jiang-ting, GUO Li-xin, FANG Quan-jie, LIU Wei

School of Sciences, Xidian University, Xi'an 710071, China

Abstract:

A vehicle flying at high velocity in the atmosphere is surrounded by plasma sheath that affects the propagation of electromagnetic waves to and from the vehicle. This plasma sheath causes an important system operation problem known as communications blackout or radio blackout. The Navier Stokes set of equations is solved, using the an advection upstream splitting method modified by the pressure based weight functions(AUSMPW+). The electron density distribution is obtained and the amount of attenuation of the signal is calculated. According to the “electromagnetic window” schematic, the propagation of electromagnetic wave in an inhomogeneous magnetized medium is simulated. Simulation results show that the electron density decreases by increasing the magnetic intensity in the electromagnetic window and this method can decrease the attenuation of electromagnetic wave propagation in plasma sheath efficiently.

Keywords: plasma sheath weight function advection upstream electromagnetic window

收稿日期 修回日期 网络版发布日期

DOI: 10.3969/j.issn.1001-506X.2011.05.01

基金项目:

通讯作者:

作者简介:

作者Email:

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