飞行器雷电效应多物理场仿真研究

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Abstract

飞行器遭受雷击时会产生多物理效应，包括电磁感应效应、热效应和电磁力效应等。建立三维电磁、电磁-热耦合、电磁-热-力耦合等多种典型模型进行仿真分析，通过对电势、电流、温度、电磁场和力等物理量的分析，研究飞机附着点、雷电防护布局、雷电流分布、金属网/复合材料熔蚀、机舱内电磁场分布、油箱缝隙打火、结构受力等问题。仿真结果在不同程度上可以为飞行器的雷电防护提供重要参考和设计依据。本文以COMSOL Multiphysics多物理场耦合软件为仿真分析工具，建立多种典型问题模型进行计算并对结果分析，说明雷电及其相关问题可以通过仿真分析进行评估和解决。

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Figures used in the abstract

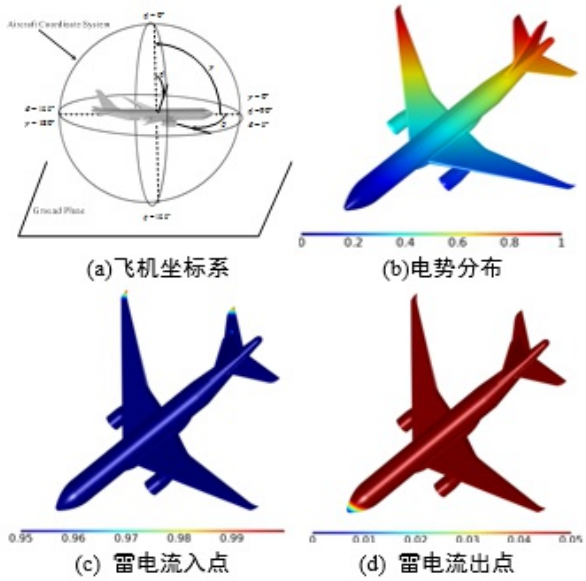


Figure 1: 飞机雷电附着点仿真结果

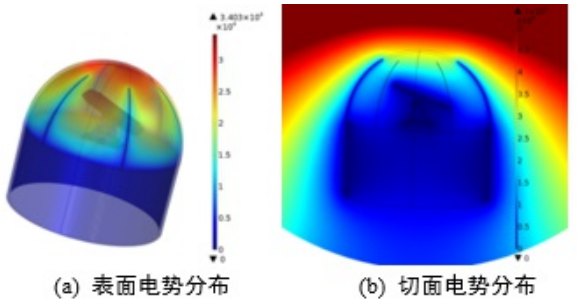


Figure 2: 雷电环境下机头雷达罩的电势分布

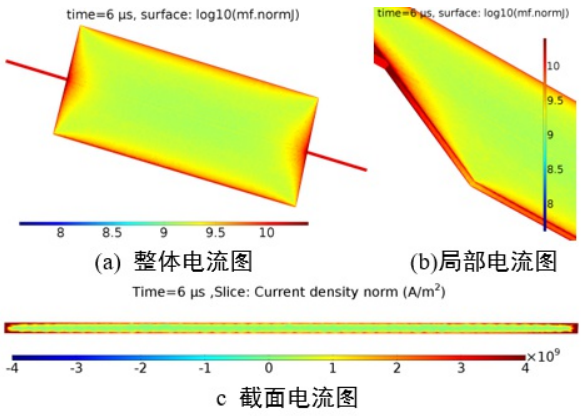
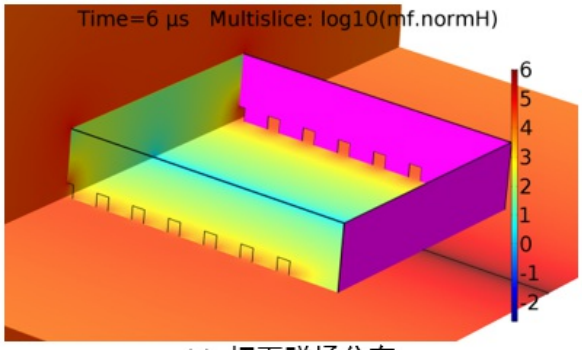
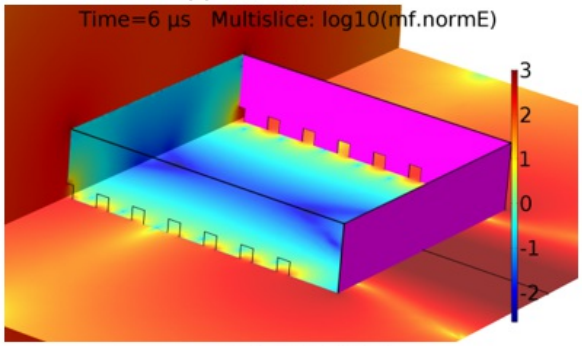


Figure 3: 雷击金属铝板的电流分布



(a) 切面磁场分布



(b) 切面电场分布

Figure 4: 雷击金属方舱的电磁场分布