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杨穆清, 马东立. 非对称地面效应对无尾飞机稳定性的影响[J]. 航空动力学报, 2013, 28(11):2553~2560

非对称地面效应对无尾飞机稳定性的影响

Effect of asymmetric ground effect on stability of tailless aircraft

投稿时间: 2013-03-27

DOI:

中文关键词: [无尾飞机](#) [地面效应](#) [气动特性](#) [横向稳定性](#) [航向稳定性](#)英文关键词: [tailless aircraft](#) [ground effect](#) [aerodynamic characteristics](#) [lateral stability](#) [directional stability](#)

基金项目:

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中文摘要:

针对非对称地面效应, 重点研究了非对称地面效应对飞机横向和航向气动特性的影响. 采用计算流体力学(CFD)方法研究了机翼弦平面距甲板高度、雷诺数和甲板风速的影响, 并通过与以往文献中的试验数据对比, 验证了CFD方法的准确性. 机翼弦平面高度是升力、滚转力矩和偏航力矩最主要的影响因素, 降低机翼弦平面高度会减弱横向和航向稳定性. 机翼弦平面高度从1.5m降低到1.2m和1.0m时, 横向稳定性分别降低了2.8%和5.6%. 增加雷诺数能够显著提高升力, 但对偏航力矩影响不大. 增加甲板风速能提高升力和滚转力矩的绝对值. 甲板风速从0m/s增加到15m/s, 升力和滚转力矩仅变化1.1%和3.4%, 因此甲板风速的作用是次要的.

英文摘要:

The research focus was put on asymmetric ground effect, especially on the lateral and directional aerodynamic characteristics. Effects of height of wing chord plane to deck, Reynolds number and wind over deck (WOD) were studied. Computational fluid dynamics (CFD) method was used and validated by comparing with the experimental data presented in previous reports. Height of wing chord plane to deck is the most important factor that influences lift, rolling moment and yawing moment. Lateral and directional stabilities are weakened by reducing height of wing chord plane to deck. Lateral stability decreased 2.8% and 5.6% as the height of wing chord plane to deck was reduced from 1.5m to 1.2m and 1.0m, respectively. By increasing Reynolds number, lift is increased significantly, while yawing moment is little influenced. Magnitudes of both lift and rolling moment are amplified slightly with the increase of WOD. When WOD varied from 0m/s to 15m/s, lift and rolling moment varied only within 1.1% and 3.4%, respectively. Thus the effect of WOD is found to be secondary.

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