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基于自由尾迹分析的直升机旋翼下洗流场计算方法 无

摘要: 建立一个包含机身影响的旋翼自由尾迹分析模型, 以用于实际直升机旋翼和机身组合时的旋翼诱导速度场计算, 为火箭导弹发射提供一个旋翼下洗流场计算方法。在该模型中, 使用一个卷起桨尖涡模拟尾迹的影响, 采用二阶升力线理论代替桨叶的作用, 并采用一个源面元模型计入机身对旋翼尾迹的诱导和堵塞等影响; 分别以美国佐治亚理工学院和马里兰大学所采用的旋翼/机身组合模型为算例, 对多种状态进行计算; 将计算的旋翼流场定常和非定常速度与可得到的实验结果进行对比, 表明了本方法的有效性。

关键词: 流体力学; 下洗流; 直升机; 旋翼; 桨尖涡; 自由尾迹

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参考文献:

- [1] 魏靖彪, 孙传杰, 薛晓中, 等. 悬停直升机桨叶下方的旋翼诱导流动计算 [J]. 弹道学报, 2002, 14(4): 78-80.
WEI Jing biao, SUN Chuan jie, XUE Xiao zhong, et al. Calculation of rotor induced flow under the helicopter blades during the hover condition [J]. Journal of Ballistics, 2002, 14(4): 78-80. (in Chinese)
- [2] 乐贵高, 马大为, 张福祥. 火箭燃气喷流的数值和实验研究 [J]. 航空学报, 1996, 17(5): 586-589.
LE Gui gao, MA Da wei, ZHANG Fu xiang. Numerical and experimental studies of jet flow exhausting from rocket [J]. Acta Aeronautica ET Astronautica Sinica, 1996, 17(5): 586-589. (in Chinese)
- [3] 周克栋, 李志刚. 直升机旋翼下洗流场和发射弹箭初始弹道的相似性初步研究 [J]. 兵工学报, 1997, 18(1): 18-22.
ZHOU Ke dong, LI Zhi gang. A preliminary study on the similarity of rotor wing down wash flow field and initial trajectory produced by rockets launched from a helicopter [J]. Acta Armamentarii, 1997, 18(1): 18-22. (in Chinese)
- [4] Bagai A, Leishman J G. Rotor free wake modeling using a pseudo implicit algorithm [J]. Journal of Aircraft, 1995, 32(6): 1276-1285.
- [5] Clark D R, Leiper A C. The free wake analysis a method for the prediction of helicopter rotor hovering performance [J]. Journal of the American Helicopter Society, 1970, 15(1): 3-11.
- [6] Landgrebe A J. An analytical and experimental investigation of helicopter rotor hover performance and wake geometry characteristics [R]. USAAMRDL TR, 1971: 71-34.
- [7] Sadler S G. Development and application of a method for predicting rotor free wake positions and resulting rotor blade airloads [R]. NASA CR 1911, 1971.
- [8] Bliss D B, Teske M E, Quackenbush T R. Free wake calculations using curved vortex elements [C]. Proc of at the International Conference on Rotorcraft Basic Research, 1985.
- [9] 徐国华, 王适存. 前飞状态直升机旋翼的自由尾迹计算 [J]. 南京航空航天大学学报, 1997, 29(6): 648-653.
XU Guo hua, WANG Shi cun. Free wake calculation for helicopter rotor in forward flight [J]. Journal of Nanjing University of Aeronautics & Astronautics, 1997, 29(6): 648-653. (in Chinese)
- [10] Rossow V J. On the invisid rolled up structure of lift generated vortices [J]. Journal of Aircraft, 1973, 10(11): 647-650.
- [11] 赵景根, 徐国华, 王适存. 前飞状态直升机旋翼/机身非定常气动干扰的分析 [J]. 流体力学实验与测量, 2000, 14(3): 18-24.
ZHAO Jing gen, XU Guo hua, WANG Shi cun. Analysis of unsteady aerodynamic interactions between rotor and fuselage of helicopters in forward flight [J]. Experiments and Measurements in Fluid Mechanics, 2000, 14(3): 18-24. (in Chinese)
- [12] Komerath N M, Mavris D M, Liou S G. Prediction of unsteady pressure and velocity over a rotorcraft in forward flight [J]. Journal of Aircraft, 1991, 28(8): 509-516.
- [13] Leishman J G, Bi N P. Measurement of a rotor flowfield and the effects on a fuselage in forward flight [J]. Vertica, 1990, 14(3): 401-415.

A Calculating Method of Helicopter Rotor Downwash Flowfield Based on Free Wake Analysis

ZHAO Jing gen, XU Guo hua, ZHAO Qi jun

anjing University of Aeronautics and Astronautics, Nanjing

Abstract: A rotor free wake model including fuselage effects was established to predict the rotor induced velocity flowfield of a real helicopter which has a combined rotor and fuselage configuration, and

to provide a calculating method of the downwash flowfield for airborne rocket or missile fire. In this model, a rolled up tip vortex model was used to simulate the effects of the wake on the flowfield, a second order lifting line model was adopted to represent the effects of the blade on the flowfield and a source panel model was included to take into account the induced and obstructed effects of the fuselage on the rotor wake. Based upon the free wake model, numerical examples for a 4 blade combined rotor and fuselage configuration of University of Maryland and a 2 blade combined rotor and fuselage configuration of the Georgia Tech were given. The computations of steady and unsteady flow velocities were carried out. The comparison between calculated result and available experimental data shows the effectiveness of the method.

Key Words: fluidal mechanics; downwash; helicopter; rotor; blade tip vortex; free wake

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