空气动力学学报
ACTA AERODYNAMICA SINICA
ISSN 0258-1825 CN 51-1192/TK 邮发代号：62-27
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空气动力学学报 » 2013, Vol. 31 » Issue (02) :266-272 DOI:
风能专题

风力机翼型气动噪声非线性声学计算

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Aerodynamic noise prediction for wind turbine airfoils using non-linear acoustics solvers

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- 摘要
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摘要 采用非线性计算气动声学方法和基于雷诺平均NS方程的计算流体力学方法对常规尖后缘风力机翼型及其修型后的钝后缘翼型的气动噪声进行了计算。首先，对两种方法得到的翼型气动性能及翼型绕流流动进行了对比，结果表明非线性方法提供的湍流相关信息比基于雷诺平均NS方程的计算方法更加详细。然后，将声学计算结果与相关声学实验进行了对比，非线性方法对两种翼型气动噪声的预测结果与实验结果吻合良好，而基于雷诺平均NS的计算方法则明显低估了尖后缘风力机翼型的气动噪声。最后，对两种翼型不同的噪声产生机理进行了分析，并讨论了两种计算方法不同的数值模拟能力。

关键词： 气动噪声计算 非线性声学求解 湍流人工重构 风力机翼型

Abstract: The aerodynamic noise of a conventional sharp trailing edge wind turbine airfoil and its flatback version has been predicted using a non-linear computational aeroacoustics method and a traditional Reynold averaged Navier-Stokes (RANS) computational fluid dynamics method in this paper. The flow structure obtained from the two methods is observed and compared, indicating that the non-linear method can provide much more detailed turbulence informations than the traditional RANS method. Compared with the aeroacoustics experimental data, results from the non linear method show good agreement for both airfoils, while the other method gives an obvious underestimate for the sharp trailing edge airfoil. Finally, different noise generation mechanisms of the two airfoils are analyzed and different simulation capabilities of the two methods are discussed.

Keywords:

收稿日期: 2012-02-11;

基金资助:

国家高技术研究发展计划(863计划)项目资助(No.2012AA051301)

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引用本文:
余雷，宋文萍 .风力机翼型气动噪声非线性声学计算[J] 空气动力学学报，2013,V31(02): 266-272

YU Lei, SONG Wen-Ping .Aerodynamic noise prediction for wind turbine airfoils using non-linear acoustics solvers[J] , 2013,V31(02): 266-272

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