World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:11, No:07, 2017

Prediction of Trailing-Edge Noise under Adverse-Pressure Gradient Effect

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Abstract : For an aerofoil or hydrofoil in high Reynolds number flows, broadband noise is generated efficiently as the result of the turbulence convecting over the trailing edge. This noise can be related to the surface pressure fluctuations, which can be predicted by either CFD or empirical models. However, in reality, the aerofoil or hydrofoil often operates at an angle of attack. Under this situation, the flow is subjected to an Adverse-Pressure-Gradient (APG), and as a result, a flow separation may occur. This study is to assess trailing-edge noise models for such flows. In the present work, the trailing-edge noise from a 2D airfoil at 6 degree of angle of attach is investigated. Under this condition, the flow is experiencing a strong APG, and the flow separation occurs. The flow over the airfoil with a chord of 300 mm, equivalent to a Reynold Number $4x10^5$, is simulated using RANS with the SST k-ε turbulent model. The predicted surface pressure fluctuations are compared with the published experimental data and empirical models, and show a good agreement with the experimental data. The effect of the APG on the trailing edge noise is discussed, and the associated trailing edge noise is calculated.

Keywords : aero-acoustics, adverse-pressure gradient, computational fluid dynamics, trailing-edge noise
Conference Title : ICWTNNS 2017 : International Conference on Wind Turbine Noise and Natural Sounds
Conference Location : Stockholm, Sweden
Conference Dates : July 13-14, 2017