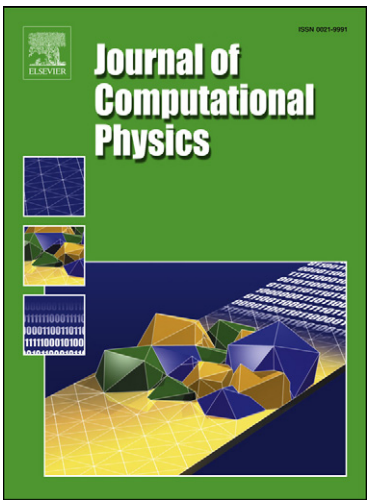

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Convergence of Fourier-based time methods for turbomachinery wake passing problems

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Abstract

The convergence of Fourier-based time methods applied to turbomachinery flows is assessed. The focus is on the harmonic balance method, which is a time-domain Fourier-based approach standing as an efficient alternative to classical time marching schemes for periodic flows. In the literature, no consensus exists concerning the number of harmonics needed to achieve convergence for turbomachinery stage configurations. In this paper it is shown that the convergence of Fourier-based methods is closely related to the impulsive nature of the flow solution, which in turbomachines is essentially governed by the characteristics of the passing wakes between adjacent rows. As a result of the proposed analysis, *a priori* estimates are provided for the minimum number of harmonics required to accurately compute a given turbomachinery configuration. Their application to several contra-rotating open-rotor configurations is assessed, demonstrating the practical interest of the proposed methodology.

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