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A Fast Numerical Algorithm for a Basic Dual Integral Equation of the Flapping Wing in a Flow of Non-Viscous Incompressible Fluid

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Abstract

The present paper proposes a new approach to the classical problem of the harmonic oscillations of a thin wing in a flow of non-viscous incompressible fluid. The problem is reduced to a dual integral equation, permitting application of numerical methods. The numerical experiments are performed by using some advanced fast non-stationary iterative methods, with the help of the two-dimensional Fast Fourier Transform. There is given a brief survey on the iterative methods, to evaluate the most efficient algorithms in application to the considered problem of the flapping wing theory.

Key words: flapping wing; dual integral equation; numerical algorithm; Toeplitz blocks; conjugate gradients; bi-conjugate gradients

1 Introduction

The aerohydrodynamics of birds' flight and swimming of fishes and dolphins was a subject of a very intensive investigation since the beginning of the 20th century, a historical survey on the mathematical simulation is presented in [1]. Among recent