Solutions of Nonlinear Bending Problems of Plates with Complex Shapes

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Abstract: A high-order wavelet method is developed for general nonlinear boundary value problems with complex boundaries in mechanics. This method is established based on wavelet approximation of multiple integrals of interval bounded functions combined with an accurate and adjustable boundary extension technique. The convergence order of this approximation has been proven to be *N* as long as a typical family of wavelets named Coiflets with *N*-1 vanishing moment are adopted, which can be any positive even integers. Error analysis has proven that the proposed method is in accuracy of order *N*, and condition numbers of relevant matrices are almost independent of the number of collocation points. Examples of a wide range of strong nonlinear problems in engineering, especially in mechanics, including the extremely large deflection bending of plates with complex shapes, demonstrate that accuracy of the proposed method is even greater than the theoretical estimated order of *N*, and most interestingly, such accuracy is independent of the order of the differential equation of a problem to be solved. Comparison to existing numerical methods further justifies the accuracy and efficiency of the proposed method.

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