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TWO-GRID METHODS FOR THE SOLUTION OF NONLINEAR WEAKLY SINGULAR INTEGRAL EQUATIONS BY PIECEWISE POLYNOMIAL COLLOCATION

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ABSTRACT. To solve nonlinear weakly singular integral equations by the piecewise polynomial collocation method, it is necessary to solve large nonlinear systems. This can be done straightforwardly only for comparatively rough discretizations. In this paper a two-grid iteration method is presented which enables us to find the solution of such systems for fine discretizations. We prove the convergence and establish the convergence rate of this method. So we generalize for nonlinear equations the results proved in [**10**] for linear equations.

1. Introduction. We shall deal with the nonlinear weakly singular integral equation

$$u(x) = \int_G K(x, y, u(y))\, dy + f(x), \quad x \in G, \tag{1}$$

where

$$G = \{x = (x_1, \dots, x_n) : \ 0 < x_k < b_k, \ k = 1, \dots, n\}$$

is an n-dimensional parallelepiped. The piecewise polynomial collocation method for the solution of such equations is considered in [**1, 5, 8, 12**]. In order to calculate the approximate solution by collocation method, large nonlinear systems must be solved. In the present paper a two-grid iteration scheme is presented for the solution of such systems. Fast convergence of this method is shown. Analogous results have been established for linear equations in [**10**] and for nonlinear equations in the case of piecewise constant collocation method in [**9**].

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