ICM 1998, Berlin, Aug. 18–27

Abstracts of Short Communications and Posters

Section:

15. Numerical Analysis and Scientific Computing

1991 MS Classification: 45, 65

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An adaptive discretization of third kind Volterra equations with weakly singular kernels

A method of piecewise constant approximation for the solution of ill-posed third kind Volterra equations

$$p(t)z(t) + \int_0^t \frac{h(t,\tau)}{(t-\tau)^{1-\alpha}} z(\tau)d\tau = f(t), \quad t \in [0,1], \ 0 < \alpha < 1,$$

is proposed. Here $p(t)$ vanishes on some subset of $[t_1, t_2] \subset [0,1]$ and $|p(t)| < \delta$ for $t \in [t_1, t_2]$, where δ is sufficiently small positive number. Proposed method gives the accuracy $O(\delta^{2\nu/(2\nu+1)})$ with respect to the L_2-norm, where ν is the parameter of sourcewise representation of exact solution on $[t_1, t_2]$, and uses no more than $O(\delta^{-(2-\lambda)/\alpha} \log^{2+1/\alpha} \frac{1}{\delta})$ values of Galerkin functionals, where $\lambda \in (0, 1/2)$ is determined in the act of choosing regularization parameter within the framework of Morozov's discrepancy principle. Part of these results is joint work with S. Prössdorf.

Reference: S. V. Pereverzev, and Prössdorf, A discretization of Volterra integral equations of the third kind with weakly singular kernels, *Journ. of Inverse and Ill-posed problems* (to appear).