

## SPLINE APPROXIMATIONS OF SOLUTION OF SINGULAR INTEGRO-DIFFERENTIAL EQUATION

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### Introduction

In this article for the equation

$$A\varphi \equiv \varphi'(t) + a(t)\varphi(t) + \frac{b(t)}{\pi} \int_{-1}^1 \frac{\varphi(\tau)d\tau}{\tau - t} = f(t), \quad -1 \leq t \leq 1, \quad (0.1)$$

with the initial condition

$$\varphi(-1) = 0 \quad (0.2)$$

the computational schemes of the spline-collocation and spline-subdomain methods are given with the theoretical substantiation of the methods (see [1], Chap.14; [2], Chap.1).

### 1. Computational scheme of the spline-collocation method

We give the computational scheme of the spline-collocation method for problem (0.1)–(0.2) for  $a(t), b(t), f(t) \in C[-1, 1]$ , where  $C[-1, 1] \equiv C$  is the space of continuous on  $[-1, 1]$  functions with the ordinary norm.

We introduce the grids of nodes

$$t_k = -1 + \frac{2k}{n}, \quad k = \overline{0, n}, \quad n \in N, \quad (1.1)$$

$$\bar{t}_{k-1} = \frac{t_{j-1} + t_j}{2} = -1 + \frac{2j-1}{2n}, \quad j = \overline{1, n}, \quad n \in N, \quad (1.2)$$

where  $N$  is the set of natural numbers. The approximate solution of problem (0.1)–(0.2) will be sought in the form of the spline

$$\varphi_n(t) = \sum_{k=0}^n \alpha_k s_k(t), \quad n \in N, \quad (1.3)$$

where

$$s_k(t) = \begin{cases} 0, & t \leq t_{k-1}; \\ \frac{t-t_{k-1}}{t_k-t_{k-1}}, & t_{k-1} \leq t \leq t_k; \\ \frac{t_{k+1}-t}{t_{k+1}-t_k}, & t_k \leq t \leq t_{k+1}; \\ 0, & t \geq t_{k+1}, \end{cases} \quad (1.4)$$

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