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ON CONSTRUCTION OF SMOOTHING HISTOSPLINES WITH BOUNDARY CONDITIONS[1]

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Let $F = (f_1, \dots, f_n)$ be a given histogram on a mesh $\triangle_n : a = t_0 < t_1 < \dots < t_n = b$ with the frequency f_i for the interval $[t_{i-1}, t_i]$, $i = 1, \dots, n$. The mesh sizes are denoted by $h_i = t_i - t_{i-1}$, $i = 1, \dots, n$. Approximating histograms F sometimes it is of interest to have a function x that satisfies not only the area matching histopolation conditions

$$\int_{t_{i-1}}^{t_i} x(t)dt = f_i h_i, \; i = 1, \dots, n, \qquad (1)$$

but also some boundary conditions. We take into account that the information of the frequencies f_i, $i = 1, \dots, n$, is obtained in practice as a result of measuring, experiment or preliminary calculations and it may be inexact. Hence it seems more natural to use constraints of two-sided inequality type instead of (1) (see [1]).

The main purpose of the present talk is to consider for given numbers $\varepsilon_i > 0$, $i = 1, \dots, n$, the following minimization problems in Sobolev space $W_2^r[a, b]$:

$$\int_a^b (x^{(r)}(t))^2 \, dt \longrightarrow \min_{x \in D_q}, \qquad (2)$$

$$D_q = \{x : \int_a^b x(t)dt = 1, |\int_{t_{i-1}}^{t_i} x(t)dt - f_i h_i| \le \varepsilon_i, i = 1, \dots, n, x^{(j)}(a) = u_j, x^{(j)}(b) = v_j, 0 \le j \le q\},$$

where $q \le r - 1$. Problem (2) without boundary conditions was investigated in [2] in a more general case. A solution of this problem belongs to the space $S_{2r,1}(\triangle_n)$ of splines of one variable of degree $2r$ and defect 1 over the mesh $\triangle_n$ (such splines are also called by histosplines).

In this research we reduce problem (2) to the problem of "almost" linear programming with some nonlinear conditions and suggest the method for finding its solution by some modification of the simplex algorithm. The proposed method is illustreted via examples.

REFERENCES

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