We give a necessary and sufficient condition for the solvability of the segmental problem (see [1]). In the case when the problem is solvable and the set of knots $\mathcal{X}_I$ is finite, we give a method to find a solution of the segmental problem.

References

[1] H. Hakopian and G. Mushyan, *On multivariate segmental interpolation problem*, Journal of Comp. Sci. and Appl. Math., **1** (2015), 19–29.

About an approach in spectral theory

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Let $\mu_n(q,\alpha,\beta)$, $n = 0,1,2,\ldots,$ are the eigenvalues of the Sturm-Liouville problem $L(q,\alpha,\beta)$:

$$-y'' + q(x)\,y = \mu y,\ x \in (0,\pi),\ q \in L^1_R[0,\pi],$$

$$y(0)\cos\alpha + y'(0)\sin\alpha = 0,\ \alpha \in (0,\pi],$$

$$y(\pi)\cos\beta + y'(\pi)\sin\beta = 0,\ \beta \in [0,\pi).$$

The first question that we want to answer is:

How the eigenvalues of the problem are moving, when (α,β) runs on $(0,\pi] \times [0,\pi)$.

For this purpose we introduce the concept of the eigenvalues function (EVF).

Definition: *The function* $\mu_q(\cdot,\cdot)$, *defined on* $(0,\infty) \times (-\infty,\pi)$ *by the formula*

$$\mu_q(\alpha + \pi k, \beta - \pi m) \overset{def}{=} \mu_{k+m}(q,\alpha,\beta),\ k,m = 0,1,2,\ldots,$$

is called the eigenvalues function (EVF) of the family of problems $\{L(q,\alpha,\beta), \alpha \in (0,\pi], \beta \in [0,\pi)\}$.

We study some properties of this function, and, in the result, the answer to our first question is:

When (α,β) runs over $(0,\pi] \times [0,\pi)$, then the set of eigenvalues form an analytic surface, and we call that surface EVF.

We find necessary and sufficient conditions for a function of two variables having these properties to be the EVF of the family of problems $\{L(q,\alpha,\beta), \alpha \in (0,\pi], \beta \in [0,\pi)\}$. In particular, an algorithm for solving the inverse problem is given.

Riemann boundary problem in weighted spaces

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Let $\rho(t) = |t-t_1|^{\alpha_1}...|t-t_m|^{\alpha_m}, t_k \in T$, where $T = \{t, |t| = 1\}$ is the unit circle, and $\alpha_k, k = 1,2,...,m$, are real numbers. We denote

$$\rho_r(t) = \rho^*(t)|r^{\delta_1}t - t_1|^{n_1}...|r^{\delta_m}t - t_m|^{n_m}$$

and $\rho^*(t) = |t-t_1|^{\lambda_m}...|t-t_1|^{\lambda_m}$, where

$$\delta_k = \begin{cases} 1, & \text{if } \alpha_k \leq -1, \\ 0, & \text{if } \alpha_k > -1, \end{cases}$$

$$n_k = \begin{cases} [\alpha_k] + 1, & \text{if } \alpha_k \text{ isn't an integer,} \\ \alpha_k, & \text{if } \alpha_k \text{ is an integer} \end{cases}$$

and $\lambda_k = \alpha_k - n_k$. It's clear that $\lambda_k \in (-1,0]$ and $\rho^*(t) \in L^1(T)$.

We consider the problem R in the following statement: