**Bahçeşehir University, Istanbul, Turkey**
**Analysis & PDE Center, Ghent University, Ghent, Belgium**
**Institute Mathematics & Math. Modeling, Almaty, Kazakhstan**

# "Analysis and Applied Mathematics"
**Weekly Online Seminar**

Seminar leaders:
Prof. Allaberen Ashyralyev (BAU, Istanbul),
Prof. Michael Ruzhansky (UGent, Ghent),
Prof. Makhmud Sadybekov (IMMM, Almaty)

Date: **Tuesday, May 16, 2023**
Time: 12.00-13.00 (Istanbul) = 11.00-12.00 (Ghent) = 15.00-16.00 (Almaty)

Zoom link: https://us02web.zoom.us/j/6678270445?pwd=SFNmQUIvT0tRaH-lDaVYrN3l5bzJVQT09, **Conference ID:** 667 827 0445, **Access code:** 1

Speaker:
# Dr. Yagub Aliyev
*ADA University, Baku - Azerbaijan*

Title: **Minimality conditions for Sturm-Liouville problems with a boundary condition depending affinely or quadratically on an eigenparameter**

Abstract: In the talk we will discuss Sturm-Liouville problems with a boundary condition depending affinely or quadratically on an eigenparameter:

$$-y'' + q(x)y = \lambda y, \qquad 0 < x < 1 \qquad (1)$$

$$y'(0) \sin \beta = y(0) \cos \beta, \qquad 0 \leq \beta < \pi \qquad (2)$$

$$y'(1) = (a\lambda^2 + b\lambda + c)y(1), \qquad\qquad (3)$$

where $\lambda$ is the spectral parameter, $q(x)$ is a real valued and continuous function on the interval $[0,1]$, and $a, b, c$ are real.

In the papers by Binding, Browne, Watson, and Code the existence and asymptotics of eigenvalues of (1)-(3) were studied. It was proved that the eigenvalues of (1)-(3) form an infinite sequence, accumulating only at $+\infty$, and the following cases are possible:

(a) All the eigenvalues are real and simple;

(b) All the eigenvalues are simple and all, except a conjugate pair of non-real, are real;

(c) All the eigenvalues are real and all, except one double, are simple;

(d) All the eigenvalues are real and all, except one triple, are simple.

The necessary and sufficient conditions for minimality and completeness of the chosen system of root functions of the corresponding operator were previously given in the form, which

uses some special associated functions. In the current talk another method with the direct use of characteristic functions will be discussed. This direct method is known for the affine case and was extensively discussed in the literature. The aim of the present paper is to develop this direct method for the quadratic case and to consider the affine and quadratic cases together in a unified way.

## Biography:

**Yagub Aliyev** is Assistant Professor at ADA University (Azerbaijan). His research interests include Sturm-Liouville theory, 3x+1 Problem, History of Mathematics, Number theory, Euclidean Geometry, Inequalities etc.