Green's Function Sign-Constancy in Fractional Differential Equations: A Subordination Approach

Rajarshi Dey

Department of Mathematics, Ariel University, Ariel-40700, Israel
RAJARSHIDEY1729@GMAIL.COM

Abstract

This talk investigates sign-constancy criteria for Green's functions associated with a broad class of fractional differential boundary value problems. The equations under consideration are driven by the Riemann–Liouville fractional derivative of order $\beta \in (n-1, n]$ and include linear continuous Volterra operators acting on the unknown function together with its derivatives.

The central idea developed in the paper is a subordination principle for the sign behavior of Green's functions across different types of boundary value problems. Starting from focal-type problems, we show how sign-constancy results can be transferred to more general settings, including multipoint and nonlocal boundary conditions.

For focal problems, we establish that the sign-constancy of the Green's function and its derivatives is equivalent to the requirement that the spectral radius of a corresponding compact operator is less than one. We also derive a Vallée–Poussin-type comparison theorem within this fractional framework.

To demonstrate the scope of the theory, several examples are presented, including equations involving integral operators and deviating arguments. In this way, the talk extends classical Vallée–Poussin theory to fractional differential equations with functional perturbations and nonlocal effects.

Key Words and Phrases: fractional differential equations; Green's function; Volterra operators; nonlocal boundary conditions; sign constancy of Green's functions; focal boundary value problems.