

Lyapunov-type Inequality and Eigen value Estimate for a Fractional Problem with Hilfer derivative

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Abstract: In this paper, we establish the Lyapunov-type inequality for fractional boundary value problem of order α , $3 < \alpha \leq 4$ defined in terms of Hilfer fractional derivative. We obtain Green's function for the corresponding boundary value problem and use a property of the Green's function to obtain the Lyapunov-type inequality. We use this inequality in two applications; first, to find lower bound for the lowest eigenvalue, and second, to find the domain in which certain combination of Mittag-Leffler functions have no zeros. We further use the Cauchy-Schwarz inequality to improve the lower bound for the smallest eigenvalue and stretch the domain in which certain combinations of Mittag-Leffler functions have no real zeros.

KEYWORDS: Lyapunov inequality, Hilfer fractional derivative, Green's function, Mittag-Leffler function, Cauchy-Schwarz inequality.