New Schemes for Solving Integral Equations and Fractional Differential Equations via Fixed Point Method

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Name of the Funding Agency
Department of Science and Technology - Science and Engineering Research Board State (DST-SERB)

Name of the Scheme
University Research Excellence (SURE)

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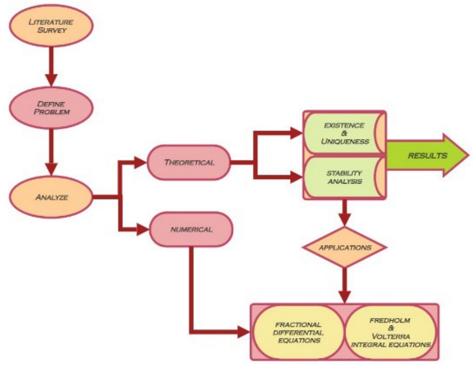
Rs. 17,62,330

Duration of the Project (years)
3

Graphical Abstract/ Layout



Project Description:

This project develops a comprehensive framework for analyzing fixed points in fractional calculus, integral equations, and control systems, with applications to non-linear matrix equations. The proposed approach encompasses both theoretical and practical dimensions. By generalizing the Banach contraction principle through (ψ, ϕ)-contractions and leveraging conditions like semi-continuity and non-decreasing properties, we establish the existence and uniqueness of solutions. The study employs b-metric spaces, which generalize distance functions, facilitating the analysis of fractional differential equations and Volterra integral equations. The conditions for the existence of the solution and Hyers-Ulam stability are derived, ensuring robustness under small perturbations. A novel fractal construction method based on generalized (ψ, ϕ)-contractions diverges from classical Banach-based approaches, enabling the generation of fractals with unique properties. This theoretical and practical framework extends fixed-point theory and demonstrates its applicability to real-world structures while ensuring stability and reliability of solutions for dynamic systems. The findings bridge theoretical advancements with real-world applicability, contributing significantly to the study of non-linear systems and fractal geometry.

Products/ Instruments/ Results/ Outreach Activities