Defence Seminar

Seminar Title	: Numerical analysis of time-fractional parabolic differential and integro-differential equations
Speaker	: Bappa Ghosh (Rollno : 520ma2009)
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Venue	: Seminar Room, MA dept
Date and Time	: 07 Jan 2025 (12. 00 Noon)

Abstract

: Over the last few decades, the study of fractional differential equations and fractional integro-differential equations has gained immense attenuation among many researchers due to their numerous applications in several fields of science and engineering. The present study intends to develop and analyze some efficient, stable numerical schemes for solving a class of time-fractional partial differential and integro-differential equations of parabolic type in one and two dimensions. This thesis can be divided into two parts. First part is devoted to constructing layer-adaptive numerical techniques for different classes of time-fractional partial differential equations (including linear, semilinear, time-delayed, and interface models). In general, a typical solution to such types of problems undergoes a sharp change at t=0, namely, the interior layer region of the domain due to the presence of weak singularity. The traditional numerical methods on uniform mesh fail to grasp such abrupt changes inside the layer region, and they degrade the convergence rate. Layer-adaptive graded mesh with the user-chosen grading parameter is used in the temporal direction to achieve optimal accuracy. The second part develops numerical techniques for time-fractional partial Volterra integro-differential equations, along with their possible extensions to problems with semilinearity. The typical solution for these problems is assumed to be sufficiently smooth, subject to the prescribed initial data. On a suitable norm, the stability and convergence for all the proposed schemes are performed thoroughly under sufficient regularity assumptions on the initial data and true solution of the considered model problem. Efficiency and applicability of the proposed schemes are tested through numerical experiments. Computational results are presented through several plots and tables to support the theoretical findings.