**Abstract for Research & Industrial Conclave 2023**

**(A novel numerical scheme for time-fractional PDE governing**

**European options in mathematical finance)**

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**Abstract**

In the financial market, the change in price of underlying stock following fractal transmission system is modeled by time-fractional Black-Scholes partial differential equations (PDEs). In this paper, we propose a numerical scheme on uniform mesh for solving time-fractional Black-Scholes PDEs governing European options. The fractional time derivative defined in the Caputo sense is discretized by using the classical $L1-$scheme and the spatial derivatives are discretized by the cubic spline method. The stability and convergence of the proposed method is analyzed and shown to be second order accurate in space with $(2-\alpha)$ order accuracy in time. Two numerical examples with exact solutions are presented to verify the efficiency and accuracy of the method validating the theoretical results. Finally, three different types of European options governed by time-fractional Black-Scholes PDE are priced using our proposed method as an application. Further, the impact of the order of time fractional derivative on the option price is shown.

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