ABSTRACT

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The research reported in this thesis deals with the finite-time stability results for multi-term fractional-order dynamical systems. The chapters discusses various types of systems such as linear and nonlinear systems, delayed systems, systems with impulses and integrodifferential systems. The main motivation of this thesis is to derive the new set of sufficient conditions for the finite-time stability of the considered systems.

The results for the considered systems are established by utilizing basic ideas of fractional calculus, Mittag-Leffler function and generalized Gronwall's inequality approach. Firstly, this work concentrates on the problem of multi-term nonlinear fractional-order system. Based on the Laplace transform and inverse Laplace transform methods the solution of the multi-term nonlinear fractional system and the stability conditions are obtained. Next the problem of multi-term fractional-order system with time delay in state variable is discussed.

Sufficient conditions for the finite-time stability of the time delayed multi-term fractional-order systems are established by using the extended form of generalized Gronwall inequality. Further, the finite-time stability results for the impulsive nonlinear multi-term fractional-order system with time-delay is studied. This technique has further been applied successfully to the problem of finite-time stability of nonlinear multi-term fractional-order system with multiple time delays in state variable.

Moreover the finite-time stability results for the nonlinear multi-term fractional-order integrodifferential system with multiple time delays in state variable is analyzed. Furthermore, the finite-time stability of impulsive fractional-order systems with multiple time varying delays is established. Finally, illustrative examples are presented in each chapter to show the applicability and effectiveness of the derived results.