

Bounded, asymptotically stable, and L^1 solutions of Caputo fractional differential equations

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Abstract: The existence of bounded solutions, asymptotically stable solutions, and L^1 solutions of a Caputo fractional differential equation has been studied in this paper. The results are obtained from an equivalent Volterra integral equation which is derived by inverting the fractional differential equation. The kernel function of this integral equation is weakly singular and hence the standard techniques that are normally applied on Volterra integral equations do not apply here. This hurdle is overcome using a resolvent equation and then applying some known properties of the resolvent. In the analysis Schauder's fixed point theorem and Liapunov's method have been employed. The existence of bounded solutions are obtained employing Schauder's theorem, and then it is shown that these solutions are indeed asymptotically stable. Finally, the L^1 properties of solutions are obtained using Liapunov's method.