On Ulam stability of a generalized delayed differential equation of fractional order. (English)


Summary: We investigate Ulam stability of a general delayed differential equation of a fractional order. We provide formulas showing how to generate the exact solutions of the equation using functions that satisfy it only approximately. Namely, the approximate solution $\phi$ generates the exact solution as a pointwise limit of the sequence $\Lambda^n\phi$ with some integral (possibly, nonlinear) operator $\Lambda$. We estimate the speed of convergence and the distance between those approximate and exact solutions. Moreover, we provide some exemplary calculations, involving the Chebyshev and Bielecki norms and some semigauges, that could help to obtain reasonable outcomes for such estimations in some particular cases. The main tool is the Diaz-Margolis fixed point alternative.

MSC:

26A33 Fractional derivatives and integrals
34D10 Perturbations of ordinary differential equations
39B82 Stability, separation, extension, and related topics for functional equations
45M10 Stability theory for integral equations
47H10 Fixed-point theorems

Keywords: fractional order derivative; delayed differential equation; Ulam stability; fixed point; semigauge; Chebyshev norm; Bielecki norm

Full Text: DOI

References:


This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.