

From Fractional Differential to Difference Equations: A Stability Perspective

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Abstract

The fractional calculus has become increasingly popular in modelling dynamical systems with memory and hereditary properties. However, despite achieving many important results, there are still challenges in the fundamental qualitative analysis of important classes of differential or difference equations. Those are mainly due to the non-locality of the fractional operator (which depends on the initial point). Consequently, autonomous equations in fact do not behave like autonomous (the group property of the flow $\phi_{s+t} = \phi_s \circ \phi_t$ is not valid any more).

Here, we present several results on the stability and asymptotic properties of some classes of fractional differential equations, with a focus on their discretisation.

References

- [1] Čermák, J., Nechvátal, L., On a problem of linearized stability for fractional difference equations, *Nonlinear Dyn.* 104 (2021), 1253–1267.
- [2] Čermák, J., Kisela, T., Nechvátal, L., The Lambert function method in qualitative analysis of fractional delay differential equations, *Fract. Calc. Appl. Anal.* 26 (2023), 1545–1565.