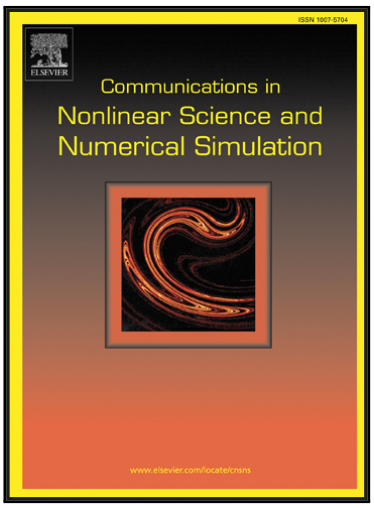

Discrete and continuous fractional persistence problems – the positivity property and applications

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Highlights

- Formulation of a new general problem : the fractional persistence problem which allows us to include many disparate results in a single strategy (see Part I, Section 1 and 2). The problem is formulated for continuous and discrete fractional systems.
- Statement and proof of a persistence theorem for fractional Caputo differential equations ensuring positivity, order-preserving, stability (see Part II, Section 4, Theorem 11). We give in particular a full proof of the positivity property in (Section 3.1, Theorem 6) completing and correcting some previous statements. We also prove a comparison Theorem (section 3.2, Theorem 9).
- We define a new numerical scheme using ideas from R. Mickens, which preserves positivity (Part III, Section 3, Definition 8) and we prove the convergence of our scheme (Section 6, Theorem 16). We also prove that this scheme preserves positivity (Section 4, Theorem 13) and other properties.
- We give several numerical simulations comparing our numerical scheme with the standard Grunwald-Letnikov scheme showing the efficiency of our algorithm (Part III, Section 7 and 8).
- We apply all our results on a fractional predator-prey model which was previously studied. This allows us to compare our method and numerical scheme to the existing results on this model. Here again, we prove that our numerical scheme is very efficient and avoid problems reported in the previous study (see Part IV, Section 3).