Positive Solutions for a System of Riemann-Liouville Fractional Differential Equations with Multi-Point Fractional Boundary Conditions

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We study the system of nonlinear ordinary fractional differential equations

$$(S)\qquad \begin{cases} D_{0+}^{\alpha}u(t)+\lambda f(t,u(t),v(t),w(t))=0, \ \ t\in(0,1),\\ D_{0+}^{\beta}v(t)+\mu g(t,u(t),v(t),w(t))=0, \ \ t\in(0,1),\\ D_{0+}^{\gamma}w(t)+\nu h(t,u(t),v(t),w(t))=0, \ \ t\in(0,1),\end{cases}$$

with the multi-point boundary conditions which contain fractional derivatives

$$(BC)\qquad \begin{cases} u^{(j)}(0)=0,\ j=0,\dots,n-2;\ \ D_{0+}^{p_1}u(1)=\displaystyle\sum_{i=1}^{N}a_iD_{0+}^{q_1}u(\xi_i),\\ v^{(j)}(0)=0,\ j=0,\dots,m-2;\ \ D_{0+}^{p_2}v(1)=\displaystyle\sum_{i=1}^{M}b_iD_{0+}^{q_2}v(\eta_i),\\ w^{(j)}(0)=0,\ j=0,\dots,l-2;\ \ D_{0+}^{p_3}w(1)=\displaystyle\sum_{i=1}^{L}c_iD_{0+}^{q_3}w(\zeta_i),\end{cases}$$

where λ, μ, $\nu > 0$, α, β, $\gamma \in \mathbb{R}$, $\alpha \in (n-1, n]$, $\beta \in (m-1, m]$, $\gamma \in (l-1, l]$, n, m, $l \in \mathbb{N}$, n, m, $l \geq 3$, p_1, p_2, p_3, q_1, q_2, $q_3 \in \mathbb{R}$, $p_1 \in [1, n-2]$, $p_2 \in [1, m-2]$, $p_3 \in [1, l-2]$, $q_1 \in [0, p_1]$, $q_2 \in [0, p_2]$, $q_3 \in [0, p_3]$, ξ_i, $a_i \in \mathbb{R}$ for all $i = 1, \ldots, N$ ($N \in \mathbb{N}$), $0 < \xi_1 < \cdots < \xi_N \leq 1$, η_i, $b_i \in \mathbb{R}$ for all $i = 1, \ldots, M$ ($M \in \mathbb{N}$), $0 < \eta_1 < \cdots < \eta_M \leq 1$, ζ_i, $c_i \in \mathbb{R}$ for all $i = 1, \ldots, L$ ($L \in \mathbb{N}$), $0 < \zeta_1 < \cdots < \zeta_L \leq 1$, and D_{0+}^k denotes the Riemann-Liouville derivative of order k (for $k = \alpha, \beta, \gamma, p_1, q_1, p_2, q_2, p_3, q_3$).
Under some assumptions on the functions f, g and h, we give intervals for the parameters λ, μ and ν such that positive solutions of $(S)-(BC)$ exist (see [1]). The nonexistence of positive solutions for the above problem is also investigated. In the proof of our existence results we use the Guo-Krasnosel'skii fixed point theorem.

Bibliography

[1] R. Luca, *Positive solutions for a system of Riemann-Liouville fractional differential equations with multi-point fractional boundary conditions*, Bound. Value Probl., 2017:102 (2017), 1-35.

Boolean asynchronous systems: the concept of attractor

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The Boolean asynchronous systems are systems generated by the functions $\Phi : \{0,1\}^n \longrightarrow \{0,1\}^n$ which iterate their coordinates independently on each other. Our purpose is to introduce their attractors by analogy with the dynamical systems literature.
The attractors are defined by Andrew Ilachinski in a real space, real time context (David Ruelle, Floris Takens, Jean-Pierre Eckmann and Robert Devaney are also cited) as sets that fulfill invariance, attractivity, minimality and topological transitivity is mentioned also.
John Milnor refers to real space, discrete time dynamical systems. He defines the trapped attractors, the trapping neighborhoods (or trapped attracting sets) and finally the attractors, in a manner that proves to be equivalent to that of D. V. Anosov, V. I. Arnold, Michael Brin, Garrett Stuck, Boris Hasselblatt, Anatole Katok and Jurgen Jost.
Such suggestions that we have grouped around the ideas of Ilachinski and Milnor bring in the Boolean asynchronous context a unique concept of attractor.