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Lamiae Maia
(Mohammed V University in Rabat)

Stieltjes differential equations: existence and multiplicity results, applied to a species persistence model

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Recently, the theory involving Stieltjes derivatives has gained the interest of many researchers. By means of the definition of the Stieltjes derivative, Stieltjes differential equations provide a unified framework to differential equations, discrete equations, dynamic equations on time scales and differential equations with impulses at fixed times. Moreover, they are particularly useful for modeling evolution processes presenting sudden changes and stationary periods. Building on this motivation, and via new notions of strict lower and upper solutions and the fixed point index theory, we have established existence and multiplicity results for the periodic problem, without monotonicity condition involving the right-hand side f at the discontinuity points of the derivator g. Multiplicity results are also obtained for the initial value problem. Finally, we present an application of our result to study the persistence of a population potentially subject to extreme events.

References

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