Stochastic Arithmetic as a Tool to Study the Stability of Biological Models

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Stochastic arithmetic has been introduced since more than forty years by M. La Porte and Jean Vignes. It has been first proposed as an experimental statistical method called the CESTAC method to estimate the accuracy on the result of numerical program [4]. An abstract formalization of the theory called Stochastic Arithmetic has been developed and many of its algebraic properties have been studied,[2]. Here a brief presentation of stochastic arithmetic, of it's main properties and of the different software existing for it's implementation are given. Then it is shown that stochastic arithmetic can be easily used to experimentally study the stability of many differential systems proposed as models for biological processes. The stability can be studied with respect to the coefficients of the model or with respect to the initial conditions. Some examples based on the Monod equation and taken from the literature are given [3], [1]. In the end it is also shown that the same method can be used to detect instabilities due to used the solver.

References

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