Analytical and numerical solutions of fuzzy differential equations

Abstract

In this paper, we study analytical and numerical solutions of fuzzy differential equations based on the extension principle. For linear fuzzy differential equations, we state some results on the behaviour of the solutions and study their relationship with the generalised Hukuhara derivative. In order to approximate the solutions of linear and non-linear fuzzy differential equations, we propose a new fuzzification of the classical Euler method and then incorporate an unconstrained optimisation technique. This combination offers a powerful tool to tackle uncertainty in any numerical method. An efficient computational algorithm is also provided to guarantee the convexity of fuzzy solutions on the time domain. Several illustrative examples are given.

Keywords