

# Abstract

The concept of fuzzy fractional differential equation (FFDE) was introduced by Agarwal, Lakshmikantham and Nieto [1]. We develop this concept of fuzzy fractional differential equation and obtain some results about existence and uniqueness of solution of FFDE.

In the second chapter we recall some basic knowledge of fuzzy calculus and fractional calculus.

In third chapter we introduce the concept of Riemann-Liouville integral and Riemann-Liouville derivative for fuzzy functions. Fuzzy derivative is considered in the Seikkala sense. Moreover we give the new results about the properties of fuzzy fractional integral and fuzzy fractional derivative. Further, we study the existence and uniqueness of the solution for a class of fractional differential equation with fuzzy initial value. The fractional derivatives are considered in the Riemann-Liouville sense.

In fourth chapter we establish that fuzzy fractional differential equation is equivalent to the fuzzy integral equation and using this equivalence we prove the existence and uniqueness of solution of fuzzy fractional differential equation. Fuzzy derivative is considered in the Goetschel-Voxman sense. Also the applications of the existence and uniqueness theorem has been given.

In fifth chapter we present results regarding the existence of the solutions of fuzzy fractional integral equations (FFIE). We prove the existence of the solutions of FFIE under compactness type conditions using the Hausdorff measure of noncompactness. Also we prove an existence result without using noncompactness measure. For this we use a variant of the Schauder fixed point theorem in fuzzy metric space.