

Chapter 19

Solution of Fuzzy Heat Equation Under Fuzzified Thermal Diffusivity

U.M. Pirzada and D.C. Vakaskar

Abstract This paper presents a solution for a fuzzy partial differential equation with fuzzy boundary and initial conditions. The solution of fuzzy heat equation is proposed using Seikkala differentiability of a fuzzy-valued function. The effect of fuzzified thermal diffusivity is studied.

Keywords Fuzzy numbers · Heat equation · Thermal diffusivity

19.1 Introduction

Seldom it is observed that for many physical systems, involving incomplete and imprecise description which is reflected in their mathematical model. It is well known that fuzzy theory is one of the most powerful tools to study and analyze problems involving uncertainty, impreciseness, ambiguity. This motivates us to study these systems as fuzzy systems. The uncertain dynamical systems often lead to uncertain (fuzzy) partial differential equations. Fuzzy partial differential equations (FPDEs) are the generalization of partial differential equations (PDEs) in a fuzzy sense. Modeling of real situations in terms of partial differential equations involves uncertain variables and parameters (known partially or approximately). This impreciseness or uncertainty can be described mathematically using fuzzy numbers. For example, in the case of a heat equation, the temperature variable can be treated as a fuzzy variable as it is defined by linguistic states like cool, cold, normal, hot, etc. The diffusivity coefficient can be regarded as fuzzy because it may not be precisely available.

U.M. Pirzada (✉)

School of Science and Engineering, Navrachana University of Vadodara,
Vadodara 391410, India
e-mail: salmapirzada@yahoo.com

D.C. Vakaskar

Department of Applied Mathematics, Faculty of Technology and Engineering,
M.S. University of Baroda, Vadodara 390001, India
e-mail: devakaskar@gmail.com