



On variants of n -sensitivity in semiflows

Rahul Thakur and Ruchi Das 

Department of Mathematics, University of Delhi, Delhi, India

ABSTRACT

We introduce various types of n -sensitivity, such as multi- n -sensitivity, strong n -sensitivity, syndetic n -sensitivity, thick n -sensitivity and thickly syndetic n -sensitivity in general semiflows, and provide several sufficient conditions under which a semiflow possesses such notions. We prove that multi- n -sensitivity, thick n -sensitivity and thickly syndetic n -sensitivity are all equivalent for an almost open P - M -semiflow whose acting semigroup is discrete and abelian. We also discuss the relationships among these notions, and provide examples wherever implications are not true.

ARTICLE HISTORY

Received 21 December 2021

Accepted 14 July 2022

KEYWORDS

Semiflow; n -sensitivity; multi- n -sensitivity; thick n -sensitivity; thickly syndetic n -sensitivity

2020 MATHEMATICS

SUBJECT

CLASSIFICATIONS

37B05; 37B99

1. Introduction

Dynamical system is one of the well developed and widely applicable branches of mathematics. It is a system in which a function describes the time dependence of a point in a geometrical space. In recent years, there has been a significant study of dynamical systems under general semigroup actions. By a *semiflow*, we mean a *topological dynamical system* which is an action of a topological semigroup on a metric space. *Chaos* is one of the important phenomena in the theory of semiflows which is being extensively studied. The first paper that described the mathematical concept of chaos in a rigorous way is that of Li and Yorke [11]. As the theory of chaos studies the behaviour of highly sensitive semiflows, *sensitivity* is an integral part in the study of chaos in semiflows. The notion of sensitivity was introduced by Auslander and Yorke [1] for *cascades*. Later, Devaney [2] introduced *Devaney chaos* and emphasized the significance of sensitivity in chaos. A semiflow is said to have Devaney chaos if it is *transitive*, *sensitive* and the set of its *periodic points* is dense in the phase space. Since a small perturbation in the initial conditions of a semiflow leads to drastically different behaviour, it is important to measure the strength of sensitivity. In order to do so, Moothathu [16] proposed some stronger forms of sensitivity, namely *multi-sensitivity*, *strong sensitivity* and *syndetic sensitivity* for cascades. Recently, Wang et al. [20] introduced and studied *thick sensitivity* and *thickly syndetic sensitivity* for general semiflows. Moreover, several other stronger forms of sensitivity have been studied by many researchers [4,5,8,9,13].