

IMPULSIVE FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS: EXISTENCE AND MULTIPLICITY OF SOLUTIONS

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Abstract. In this work we present some new results concerning the existence and multiplicity of global classical solutions to a class of impulsive first order nonlinear partial differential equations. We give conditions under which the considered equations have at least one and at least two classical solutions. Our method to prove our main results involves a new topological approach based upon recent theoretical results. An example is given to illustrate our new results.

Keywords. Impulsive partial differential equations, fixed point theorems, nonlinear evolution equations, global existence, sum of operators.

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1 Introduction

Impulsive phenomena appear in the real world widely. Indeed, many phenomena in the applied sciences are abruptly changed in their states at some time instants due to short time perturbations whose duration is negligible in comparison with the duration of these phenomena. We can mention mechanical systems with impact, heart beats, blood flows, population dynamics, industrial robotics, biotechnology, economics, etc. The impulsive differential equations provide natural framework for mathematical simulation of such phenomena. However, taking more factors into account leads to the development of the theory of impulsive partial differential equations. The literature concerning impulsive differential equations is richer than the corresponding theory of impulsive partial differential equations. Some applications of the impulsive PDEs in the quantum mechanics can be found in [30]. The asymptotical synchronization of coupled nonlinear impulsive partial differential systems in complex networks was considered in [37]. Applications are given to