

Multiple Solutions of Dirichlet Problems in Billiard Spaces with Impulses at Fixed Times

David Švec

Faculty of Science, Palacký University Olomouc, Czechia
DAVID.SVEC02@UPOL.CZ

Abstract

This is a joint work with Jan Tomeček (Faculty of Science, Palacký University Olomouc, Czechia). We investigate a Dirichlet problem for an ODE of the second order with state-dependent impulses and with impulses at fixed times in the form

$$\begin{aligned}\ddot{x}(t) &= f(t, x(t)), \quad \text{for a.e. } t \in [0, T], \quad x(t) \in \text{int } K, \\ \dot{x}(s+) &= -\dot{x}(s-), \quad \text{if } s \in (0, T), \quad x(s) \in \partial K, \\ \dot{x}(t_i+) &= \dot{x}(t_i) + I_i(x(t_i)), \quad \text{if } x(t_i) \in \text{int } K, \quad i = 1, \dots, N, \\ x(0) &= A, \quad x(T) = B,\end{aligned}$$

where K is a compact interval in $\mathbb{R}$, $f : [0, T] \times K \rightarrow \mathbb{R}$ satisfies Carathéodory conditions, $A, B \in \text{int } K$, $0 < t_1 < t_2 < \dots < t_N < T$ and $I_i : K \rightarrow \mathbb{R}$, for $i = 1, \dots, N$. We can understand this impulsive differential equation as an one-dimensional billiard space with added impulses at specific times. We give existence and multiplicity result for solutions with prescribed number of impacts.