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Higher Order Boundary Value Problem for Impulsive Differential Inclusions*

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Abstract

In this paper, we present some existence results for the higher order impulsive differential inclusion:

$$\begin{cases} x^{(n)}(t) \in F(t, x(t), x'(t), \ldots, x^{(n-1)}(t)), \ a.e.\ t \in J = [0, \infty),\ t \neq t_k, \\ \hfill k = 1, \ldots, \\ \Delta x^{(i)}|_{t=t_k} = I_{ik}(x(t_k), x'(t_k), \ldots, x^{(n-1)}(t_k)),\ i = 0, 1, \ldots, n-1, \\ \hfill k = 1, \ldots, \\ x^{(i)}(0) = x_{0i},\ (i = 0, 1, \ldots, n-2),\ x^{(n-1)}(\infty) = \beta x^{(n-1)}(0), \end{cases}$$

where $F : \mathbb{R}_+ \times E \times E \times \cdots \times E \to \mathcal{P}(E)$ is a multifunction, $x_{0i} \in E, i = 0, 1, \ldots, n-1,$ $0 = t_0 < t_1 < \cdots < t_m < \cdots, \lim_{k\to\infty} t_k = \infty,$ $I_{ki} \in C(E \times \cdots \times E, E)$ $(i = 1, \ldots, n-1,\ k = 1, \ldots,)$, $\Delta x|_{t=t_k} = x(t_k^+) - x(t_k^-), x(t_k^+) = \lim_{h\to 0^+} x(t_k + h)$ and $x(t_k^-) = \lim_{h\to 0^+} x(t_k - h)$ represent the right and left limits of $x(t)$ at $t = t_k$, respectively, $x^{(n-1)}(\infty) = \lim_{t\to\infty} x^{(n-1)}(t)$, and $(E, |\cdot|)$ is real separable Banach space. We present some existence results when the right-hand side multivalued nonlinearity can be either convex or nonconvex.

MSC: 34K45, 34A60, 47D62, 35R12

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