

FIXED TIME IMPULSIVE DIFFERENTIAL INCLUSIONS

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Abstract. In the paper we study weak and strong invariance of differential inclusions with fixed time impulses and with state constraints.

We also investigate some properties of the solution set of impulsive system without state constraints. When the right-hand side is one sided Lipschitz we prove also the relaxation theorem and study the funnel equation of the reachable set.

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References

- [1] J.-P. Aubin, *Viability theory*. Systems & Control: Foundations & Applications, Birkhäuser, Boston, 1991. [MR1134779](#) (92k:49003). [Zbl 0755.93003](#).
- [2] J.-P. Aubin, J. Lygeros, M. Quincampoix, S.Sastry and N. Seube, *Impulse differential inclusions: a viability approach to hybrid systems*, IEEE Trans. Automat. Control **47**(1) (2002) 2-20. [MR1879687](#)(2002k:49039).
- [3] M. Benchohra and A. Boucherif, *On first order initial value problems for impulsive differential inclusions in Banach spaces*, Dyn. Syst. Appl. **8** (1999) 119-126. [MR1669010](#)(2000b:34015). [Zbl 0929.34017](#).
- [4] M. Benchohra, J. Henderson and S. Ntouyas, *Impulsive Differential Equations and Inclusions*, Hindawi Publishing Company, New York (in press).
- [5] M. Benchohra, J. Henderson, S. Ntouyas and A. Ouhabi, *Existence results for impulsive lower semicontinuous differential inclusions*, Int. J. Pure Appl. Math. **1** (2002) 431-443. [MR1914474](#)(2003d:34021). [Zbl 1014.34005](#).
- [6] D. Bothe, *Multivalued Differential Equations on Graphs and Applications*, Ph.D. Thesis, Paderborn, 1992. [Zbl 0789.34013](#).

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- [7] A. Bressan and G. Colombo, *Selections and representations of multifunctions in paracompact spaces*, Studia Math. **102** (1992) 209-216. [MR1170551](#) (93d:54032). [Zbl 0807.54020](#).
- [8] F. Clarke, Yu Ledyaev and M. Radulescu, *Approximate invariance and differential inclusions in Hilbert spaces*, J. Dynam. Control Syst. **3** (1997) 493-518. [MR1481624](#) (98k:49011). [Zbl 0951.49007](#).
- [9] F. Clarke, Yu Ledyaev, R. Stern and P. Wolenski, *Nonsmooth Analysis and Control Theory*, Springer, New York, 1998. [MR1488695](#) (99a:49001). [Zbl 1047.49500](#).
- [10] K. Deimling, *Multivalued Differential Equations*, De Gruyter Berlin, 1992. [MR1189795](#) (94b:34026). [Zbl 0760.34002](#).
- [11] T. Donchev, *Functional differential inclusions involving dissipative and compact multifunctions*, Glasnik Matematički **33(53)** (1998) 51-60. [MR1652796](#)(99j:34116). [Zbl 0913.34015](#).
- [12] T. Donchev, *Properties of the reachable set of control systems*, System & Control Letters **46** (2002) 379-386. [MR2011325](#) (2004g:34015). [Zbl 1003.93003](#).
- [13] T. Donchev, *Impulsive differential inclusions with constraints*, Electron. J. Differential Equations 2006, No. 66, pp. 1-12. [MR2240814](#) (2007e:34019). [Zbl pre05142030](#).
- [14] T. Donchev, V. Rios and P. Wolenski, *Strong invariance for discontinuous differential inclusions in a Hilbert space*, An. Stiint. Univ. Al. Cuza Iasi, Tomul **LI**, S. I-a, Matematica, (2005), f.2, 265-279. [MR2227066](#) (2007b:34022). [Zbl 1112.34038](#).
- [15] S. Hu, N. Papageorgiou, *Handbook of Multivalued Analysis*, vol. I Theory 1997, Kluwer Dodrecht. [MR1485775](#) (98k:47001). [Zbl 0887.47001](#); vol. II Applications 2000, Kluwer Dodrecht. [MR1741926](#) (2001g:49001). [Zbl 0943.47037](#).
- [16] V. Lakshmikantham, D. Bainov and P. Simeonov, *Theory of Impulsive Differential Equations*, World Scientific, Singapore, 1989. [MR1082551](#) (91m:34013). [Zbl 0719.34002](#).
- [17] A. Panasiuk and V. Panasiuk, *About an equation given by differential inclusion*, Math. Notes. **27** (1980) 429-437. (in Russian)
- [18] V. Plotnikov, R. Ivanov and N. Kitanov, *Method of averaging for impulsive differential inclusions*, Pliska. Stud. Math. Bulgar. **12** (1998) 43-55. [MR1686520](#) (2000a:34026). [Zbl 0946.49030](#).

- [19] V. Plotnikov, A. Plotnikov and A. Vityuk, *Differential Equations with Multivalued Right-Hand Side. Asymptotic Methods*, Astro Print Odessa, 1999. (Russian)
- [20] A. Samoilenko and N. Peresyuk, *Differential Equations with Impulsive Effects*, World Scientific, Singapore, 1995.
- [21] A. Tolstonogov, *Differential Inclusions in a Banach Space*, Kluwer, Dordrecht, 2000. [MR1888331](#)(2003g:34129). [Zbl 1021.34002](#).
- [22] P. Watson, *Impulsive differential inclusions*, *Nonlin. World* **4** (1997) 395-402. [MR1703059](#)(2000e:34018). [Zbl 0944.34007](#).

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