PRACTICAL STABILITY OF NONLINEAR TIME-VARYING IMPULSIVE CASCADE SYSTEMS

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Abstract. In this article practical stability of impulsive time-varying cascade systems is investigated. In this way, we extend some existing results under more generalized assumptions. Examples are given to show the feasibility of our results.

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Key words. Cascade systems, Lyapunov theory, practical stability, impulsive equation.

REFERENCES

[1] J.P. Aubin, *Impulse Differential Inclusions and Hybrid Systems: a Viability Approach*, Lecture Notes, Université Paris-Dauphine, 2002.

[2] D.D. Bainov, V. Lakshmikantham and P.S. Simeonov, *Theory of Impulsive Differential Equations*, World Scientific, Singapore, 1989.

[3] A. Benabdallah, I. Ellouze and M. Hammami, *Pratical stability of nonlinear time-varying cascade systems.* J. Dyn. Control Syst., **15** (2009), 45–62.

[4] D. Beldjerd, L. Oudjedi and M. Remili, *Practical exponential stability of nonlinear timevarying cascade systems.* Rev. Roumaine Math. Pures Appl., **60** (2015), 1–16.

[5] A. Chaillet and A. Loria, *Necessary and sufficient conditions for uniform semiglobal pratical asymptotic: Application to cascade systems*, Automatica **42** (2006), 1899–1906.

[6] M. Corless, *Guaranteed rates of exponential convergence of uncertain systems*, J. Optim. Theory Appl., **64** (1990), 481–494.

[7] J.R. Graef, J. Henderson and A. Ouahab, *Impulsive Differential Inclusions: A Fixed Point Approach*, De Gruyter Series in Nonlinear Analysis and Applications, **20**, de Gruyter, Berlin, 2013.

[8] W. M. Haddad and V. Chellaboina, *Nonlinear Dynamical Systems and Control*, Princeton University Press, Princeton, 2008.

[9] J.K. Hale, *Ordinary Differential Equations*, Krieger Publishing Company Malabar, Florida, 1980.

[10] M. Jankovic, R. Sepulchre and P.V. Kokotovic, *Constructive Lyapunov stabilisation of nonlinear cascade systems*, IEEE Trans. Automat. Control, **41** (1996), 1723–1736.

[11] H.K. Khalil, *Nonlinear Systems*, Prentice-Hall, New York, 2002.

[12] V. Lakshmikantham, S. Leela and A.A. Martyuk, *Practical Stability of Nonlinear Systems*, World Scientific, 1990.

[13] N.M. Linh and V.N. Phat, *Exponential stability of nonlinear time-varying differential equations and applications*, Electron. J. Differential Equations, **2001**, *34* (2001), 1–13.

[14] H.J. Marquez, *Nonlinear Control Systems Analysis and Design.* Wiley Interscience, 2003.

[15] E. Panteley and A. Loria, *On global uniform asymptotic stability of nonlinear time-varying systems in cascade*, Systems Control Lett., **33** (1998), 131–138.

[16] E. Panteley and A. Loria, *Growth rate conditions for uniform asymptotic stability of cascade time-varying systems.* Automatica, **37** (2001), 453–460.

[17] A. Saberi, P.V. Kokotovic and H.J. Sussman, *Global stabilization of partially linear composed systems*, SIAM J. Control Optim., **28** (1990), 1491–1503.

[18] A.M. Samoilenko and N.A. Perestyuk, *Impulsive Differential Equations*, World Scientific, Singapore, 1995.

[19] P. Seibert and R. Suarez, *Global stabilization of nonlinear cascade systems*, Systems Control Lett., **14** (1990), 347–352.

[20] Y.J. Sun, C.H. Lien and J.G. Hsieh, *Global exponential stabilisation for a class of uncertain nonlinear systems with control constraints*, IEEE Trans. Automat. Control, **43** (1998), 674–677.

[21] H.J. Sussmann and P.V. Kokotović, *The peaking phenomenon and the global stabilization of nonlinear systems*, IEEE Trans. Automat. Control, **36** (1991), 424–439.

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