EXPONENTIAL AND FRACTIONAL DISCRETE MODELS FOR A TWO-INNOVATION DIFFUSION SYSTEM

Lu Zhang and Wenying Feng

Department of Computing & Information Systems
Department of Mathematics
Trent University
Peterborough, Ontario K9J 7B8, Canada

Abstract. In this paper, we study the exponential and fractional discrete dynamic models for a system of two-innovation diffusion. First, the discretizing methodologies of deriving the two models from the corresponding differential equations are discussed respectively. Then stability and bifurcation for the two analogs are obtained by linearizing analysis. At last, comparisons between the Euler, exponential, and fractional discrete time models are displayed in simulation by a case application.

Keywords. Innovation diffusion, stability, bifurcation, exponential discrete model, fractional discrete model.

AMS (MOS) subject classification: 37N99, 93A30

References

[1] H. Jaakkola, M. Gabbouj and Y. Neuvo, Fundamentals of technology diffusion and mobile phone case study. Circuits, Systems, and Signal Processing, Volume 17, Number 3, 421-448, (1998).

[2] Y. Kwon, S.W. Kim, S. Park, S.H. Lim, J. B. Lee, The information diffusion model in the blog world. SNA-KDD '09 Proceedings of the 3rd Workshop on Social Network Mining and Analysis, Paris, France (2009).

[3] F. Bass, A new-product growth model for consumer durables. Management Sci. 15(1) 215-227, (1969).

[4] J. Norton, F. Bass, A diffusion theory model of adoption and substitution for successive generations of high-technology products. Management Sci. 33(9) 1069-1086, (1987).

[5] V. Mahajan, E. Muller, Timing, diffusion, and substitution of successive generations of technological innovations: the IBM mainframe case. Tech. Forecasting Soc. Change 51 109-132, (1996).

[6] N. Meade, T. Islam, Modeling and forecasting the diffusion of innovations-A 25-year review. J. forecasting 22 519-545, (2006).

[7] S. Dewan, D. Ganley, and K. L. Kraemer, Complementarities in the diffusion of personal computers and the Internet: implications for the global digital divide. Information Systems Research, Articles in advance, 1-17 (2007).

[8] P. Liu, X. Cui, A discrete model of competition. Mathematics and Computers in Simulation 49, 1-12, (1999).

[9] W. Feng, and L. Zhang, Comparisons of stability for continuous and discrete model of two-innovations diffusion system. Manuscript, (2012).

[10] R C.Robinson, An Introduction to Dynamical Systems: Continuous and Discrete, Pearson Prentice Hall, 2004.

http://monotone.uwaterloo.ca/∼journal/