

种群动力系统的数值解的振动性分析

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OSCILLATION ANALYSIS OF NUMERICAL SOLUTIONS FOR NONLINEAR DELAY DIFFERENTIAL EQUATIONS OF POPULATION DYNAMICS

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摘要 本文主要研究下面动力系统的非线性延迟微分方程 $x'(t) + ((aV_m x(t)x^p(t-\tau)))/(\beta^p + x^p(t-\tau)) = \lambda, t \geq 0$ 数值解的振动性. 这是由 Mackey 和 Glass^[1]提出来的关于动力系统疾病的方程. 本文得到了数值方法振动的条件. 同时对非振动的数值解的性质也做了研究, 为了验证得到的结果, 给出了数值算例.

关键词: 振动 非线性 延迟微分方程 数值方法 动力系统

Abstract: This paper is concerned with oscillations of numerical solutions for the nonlinear delay differential equation of population dynamics $x'(t) + ((aV_m x(t)x^p(t-\tau)))/(\beta^p + x^p(t-\tau)) = \lambda, t \geq 0$. The equation proposed by Mackey and Glass^[1] for a “dynamic disease”. Some conditions under which the numerical method is oscillatory are obtained. The properties of non-oscillatory numerical solutions are investigated. To verify our results, we give numerical experiments.

Key words: oscillation nonlinear delay differential equations numerical methods population dynamics

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[1] Mackey M C, Glass L. Oscillation and chaos in physiological control system[J]. Science, 1977, 197: 287-289. 


[2] Kong Q. Oscillation and asymptotic behavior of a discrete logistic model[J]. Rocky Mount. J. Math., 1995, 25: 339-349. 


[3] Liang H Y, Li Q L, Zhang Z G. New oscillatory criteria for higher-order nonlinear neutral delay differential equation[J]. Nonlinear Analysis TMA., 2008, 69: 1719-1731. 

[4] Peng D H, Han M A, Wang H Y. Linearized oscillations of first-order nonlinear neutral delay difference equations[J]. Comput. Math. Appl., 2003, 45: 1785-1796. 

[5] Saker S H. Oscillation of second-order nonlinear neutral delay dynamic equations on time scales[J]. J. Comput. Appl. Math., 2006, 187: 123-141. 

[6] Sun Y G, Saker S H. Oscillation for second-order nonlinear neutral delay difference equations[J]. Appl. Math. Comput., 2005, 163: 909-918. 


[7] Zaghrout A, Ammar A, El-Sheikh M M A. Oscillation and global attractivity in delay equation of population dynamics[J]. Appl. Math. Comput., 1996, 77: 195-204. 


[8] Liu M Z, Gao J F, Yang Z W. Oscillation analysis of numerical solution in the θ -methods for equation $x'(t) + ax(t) + a_1x([t ? 1]) = 0$ [J]. Appl. Math. Comput., 2007, 186: 566-578. 

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[9] Liu M Z, Gao Jianfang, Yang Z W. Preservation of oscillations of Runge-Kutta method for equation $x'(t) + ax(t) + a_1x([t ? 1]) = 0$ [J]. Comput. Math. Appl., 2009, 58: 1113-1125. 

[10] Kubiacyk I, Saker S H. Oscillation and stability in nonlinear delay differential equations of population dynamics[J]. Math. Comput. Model., 2002, 35: 295-301. 

[11] Györi I, Ladas G. Oscillation Theory of Delay Differential Equations with Applications, Academic press, Oxford, 1991.

[12] Song M H, Yang Z W, Liu M Z. Stability of θ -methods for advanced differential equations with piecewise continuous arguments[J]. Comput. Math. Appl., 2005, 49: 1295-1301. 

[13] Yang Z W, Liu M Z, Song M H. Stability of Runge-Kutta methods in the numerical solution of equation $u'(t) = au(t) + a_0u([t]) + a_1u([t ? 1])$ [J]. Appl. Math. Comput., 2005, 162: 37-50. 

[14] Landa P S. Nonlinear Oscillations and Waves in Dynamical Systems. Kluwer Academic Publishers, London, 1996.

[1] 范振成, 宋明辉. 非全局Lipschitz条件下随机延迟微分方程Euler方法的收敛性[J]. 计算数学, 2011, 33(4): 337-344.

[2] 李昊辰, 孙建强. 饱和和非线性薛定谔方程多辛Euler-box方法[J]. 计算数学, 2011, 32(3): 220-228.

[3] 祁锐, 何汉林. 非线性延迟积分微分方程单支方法的散逸性[J]. 计算数学, 2011, 32(2): 97-104.

[4] 周天孝. 弹塑性力学的典则变分原理——特此纪念冯康先生九十周年诞辰[J]. 计算数学, 2011, 32(1): 1-7.

[5] 谭英贤, 甘四清, 王小捷. 随机延迟微分方程平衡方法的均方收敛性与稳定性[J]. 计算数学, 2011, 33(1): 25-36.

[6] 苏凯, 王锦红, 张宏伟, 王晚生. 显式和对角隐式Rung-Kutta方法求解中立型泛函微分方程的非线性稳定性[J]. 计算数学, 2011, 32(1): 8-22.

[7] 王文强, 陈艳萍. 非线性随机延迟微分方程Heun方法的数值稳定性[J]. 计算数学, 2011, 33(1): 69-76.

[8] 陈争, 马昌凤. 求解非线性互补问题一个新的 Jacobian 光滑化方法[J]. 计算数学, 2010, 32(4): 361-372.

[9] 张丽炜, 倪勤. 解非线性等式约束优化问题的新锥模型信赖域算法[J]. 计算数学, 2010, 31(4): 279-289.

[10] 朱华君, 陈亚铭, 宋松和, 唐贻发. 二维非线性Schrödinger方程的辛与多辛格式[J]. 计算数学, 2010, 32(3): 315-326.

[11] 邹战勇. 关于Hamilton-Jacobi-Bellman方程的一种新的多重网格法[J]. 计算数学, 2010, 31(3): 183-190.

[12] 王文强, 陈艳萍. 线性中立型随机延迟微分方程Euler方法的均方稳定性[J]. 计算数学, 2010, 32(2): 206-212.

[13] 高岳林, 李会荣. 非线性约束优化问题的混合粒子群算法[J]. 计算数学, 2010, 32(2): 135-146.

[14] 胡鹏, 黄乘明. 非线性延迟积分微分方程线性多步法的渐近稳定性[J]. 计算数学, 2010, 31(2): 116-122.

[15] 徐金平, 单双荣. 带五次项的非线性Schrödinger方程的多辛Fourier拟谱算法[J]. 计算数学, 2010, 31(1): 55-63.

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