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两边空间-时间分数阶扩散方程的加权有限差分格式

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Weighted finite difference methods for two-sided space-time fractional diffusion equations

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- 摘要
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全文: PDF (315 KB) HTML (1 KB) 输出: BibTeX | EndNote (RIS) 背景资料

摘要 对于空间-时间分数阶扩散方程的初边值问题提出了一种加权差分格式. 利用能量估计, 得到了差分格式的稳定性. 然后使用数学归纳法证明了在相同的条件下, 所提出的的格式是收敛的. 最后通过一个例子说明了所提出的格式是可靠的、有效的.

关键词: 分数阶扩散方程 空间-时间分数阶导数 加权差分格式 收敛性 稳定性

Abstract: A weighted finite difference scheme was proposed in order to solve initial-boundary value problems of space-time fractional diffusion equations. Their stability was analyzed by means of discrete energy method. Using mathematical induction, we proved that the scheme was convergent under the same condition. Illustrative example was included to demonstrate the validity and applicability of the scheme.

Key words: fractional diffusion equation space-time fractional derivative weighted difference scheme convergence stability

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. Weighted finite difference methods for two-sided space-time fractional diffusion equations[J]. Journal of East China Normal University(Natural Sc, 2012(3): 41-48,70.

- [1] SOUSA E. Finite difference approximations for a fractional advection diffusion problem[J]. Journal of Computational Physics, 2009, 228(4038-4054.
- [2] LIU F, ZHUANG P, ANH V, et al. Stability and convergence of the difference methods for the space-time fractional advection--diffusion equation[J]. Applied Mathematics and Computation, 2007, 191(1): 2-20.
- [3] ZHUANG P, LIU F, ANH V, et al. New solution and analytical techniques of the implicit numerical method for the anomalous subdiffusion equation[J]. SIAM Journal on Numerical Analysis, 2008, 46(2): 1079-1095.
- [4] RABERTO M, SCALAS E, MAINARDI F. Waiting-times and returns in high-frequency financial data: an empirical study[J]. Physica A: Statistical Mechanics and its Applications, 2002, 314(1-4): 749-755.
- [5] SABATELLI L, KEATING S, DUDLEY J, et al. Waiting time distributions in financial markets[J]. European Physical Journal B, 2002, 27(2): : 275.
- [6] GALUE L, KALLA S L, AL-SAQABI B N. Fractional extensions of the temperature field problems in oil strata[J]. Applied Mathematics and Computation, 2007, 186(1): 35-44.
- [7] LI X, XU M, JIANG X. Homotopy perturbation method to time-fractional diffusion equation with a moving boundary[J]. Applied Mathema and Computation, 2009, 208(2): 434-439.

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- [8] ODIBAT Z, MOMANI S, ERTURK V S. Generalized differential transform method: application to differential equations of fractional order[J]. Applied Mathematics and Computation, 2008, 197(2): 67-477.
- [9] DENG W H. Finite element method for the space and time fractional Fokker-Planck equation[J]. SIAM Journal on Numerical Analysis, 2004, 47(1): 204-226.
- [10] DENG W H. Numerical algorithm for the time fractional Fokker-Planck equation[J]. Journal of Computational Physics, 2007, 227(2): 1510-1522. 
- [11] BENSON D, WHEATCRAFT S, MEERSCHAERT M. Application of a fractional advection-dispersion equation[J]. Water Resources Research, 2000, 36(2): 1403-1412. 
- [12] CLARKE D D, MEERSCHAERT M M, WHEATCRAFT S W. Fractal travel time estimates for dispersive contaminants[J]. Ground Water, 2005(3): 1-8. 
- [13] BAEUMER B, MEERSCHAERT M M, BENSON D A, et al. Subordinated advection-dispersion equation for contaminant transport[J]. Water Resources Research, 2001, 37(6): 1543-1550. 
- [14] BENSON D A, TADJERAN C, MEERSCHAERT M M, et al. Radial fractional-order dispersion through fractured rock[J]. Water Resources Research, 2004, 40(12): 1-9.
- [15] PODLUBNY I. Fractional Differential Equations[M]. [S.L]: Academic Press, 1999. 
- [16] ZHANG Y. A finite difference method for fractional partial differential equation[J]. Applied Mathematics and Computation, 2009, 215(2): 524-529. 
- [17] DING Z Q, XIAO A G, LI M. Weighted finite difference methods for a class of space fractional partial differential equations with variable coefficients[J]. Journal of Computational and Applied Mathematics, 2010, 233(8): 1905-1914. 
- [1] 张超. Banach空间中含 $\{H\}, \phi$ - η -单调算子的变分包含组[J]. 华东师范大学学报(自然科学版), 2012, 2012(1): 74-78.
- [2] 饶凤;王玮明;李志斌. 一类含时滞与收获的捕食系统的Hopf分支分析[J]. 华东师范大学学报(自然科学版), 2010, 2010(6): 186-198.
- [3] 陈会萍. DGH方程的尖峰孤立子的稳定性[J]. 华东师范大学学报(自然科学版), 2010, 2010(5): 67-72, .
- [4] 曹伟;王开荣. 一种新的修正 Liu-Storey 共轭梯度法的全局收敛性(英)[J]. 华东师范大学学报(自然科学版), 2010, 2010(1): 44-51.
- [5] 王婷;郭小林;杨生武. 随机差分方程的比较定理(英)[J]. 华东师范大学学报(自然科学版), 2008, 2008(3): 59-66.
- [6] 刘永明;. 准地转运动稳定性的数学方法[J]. 华东师范大学学报(自然科学版), 2008, 2008(1): 1-19.
- [7] 蔡景景;刘永明;. 三维球坐标准地转流的非线性稳定性(英)[J]. 华东师范大学学报(自然科学版), 2007, 2007(3): 23-30.
- [8] 李娜;刘永明. 二维准地转流的非线性稳定性及扰动发展[J]. 华东师范大学学报(自然科学版), 2005, 2005(1): 16-22.