SYNASC09 - Numerical computing

On a functional-differential equation from price theory

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Abstract. In this paper we consider the following functional-differential equation which appears in the price theory and in the dynamics of economical systems

$x'(t)=[f(x(t))-g(x(t-h))]x(t), t\in[0,T], T>0, h>0$

where f and g are given continuous functions, $f,g\in C(R+,R)$.
We give some new results about existence and uniqueness of the solution x of this equation, where $x\in C([-h,T],R+)\cap C^1([0,T],R+)$.

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MATLAB Package for Laguerre Spectral Method

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Abstract. The paper describes the MATLAB package LaguerreEig, based on Laguerre functions expansion for problems formulated on the semi-infinite interval [0,inf). Applications are given for Schroedinger equations, Arrhenius integral and some linear or nonlinear differential problems on [0,inf).

An algorithm for the approximation of the solution of a functional-integral equation

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Abstract. In this paper we consider the following functional-integral equation with linear modification of the argument:

$x(t)=\int K(t,s,x(s),x(\lambda s))ds+g(t), t\in[0,b], b>0, 0<\lambda<1,$

where $K\in C([0,b]\times[0,b]\times R^2)$ and $g\in C[0,b]$.

By applying the successive approximation method and by using the cuadrature formula of trapezium we give an algorithm for the approximation of the solution of this equation.

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Solving Nonsmooth Interval Equations with Slopes

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Abstract—In this paper, the problem of finding all zeros of a continuously interval function in a given interval is considered. We proposed a new method for solving this problem which is based on the idea of isolating the endpoints of interval zeros and the technique of interval slopes. We develop the theory of the new method and apply it on a set of smooth functions and a set of nonsmooth functions respectively. In case of smooth functions, We compare the new method to a similar one from paper[6]. In case of nonsmooth functions, we can gain the reliable results too. The numerical results show the efficiency of our new method. As far as we know, our method is the first one which deal with the nonsmooth interval equations.

Sparse Matrix Computations Using the Quadtree Storage Format

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Abstract—Computations with sparse matrices are widespread in scientific projects. Used data format affects strongly the performance. Efficient formats for storing sparse matrices are still under development, since the computation using widely-used formats (like XY or CSR) is slow and specialized formats (like SPARSITY or CARB) have a large transformation overhead. In this paper, we represent some improvements to the quadtree storage format. We also compare the performance during the execution of some basic routines from the linear algebra using widely-used formats and the quadtree storage format.

Cancer Prediction Modeling from Volumetric Data

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Abstract—This paper introduces a method for cancer predictionbased on the Fister-Panetta (FP) model for cancer growth. The FP equation includes a component for the tumor growth which describes its natural evolution without any treatment. The second component of the FP equation is represented by the contribution of the treatment scheme. Our prediction uses these two components to predict the evolution of the tumor in the near future. The prediction model uses the real information about the tumor growth in this two cases to find the best mathematical approximation with the FP equation. Then this equation is used to predict the evolution in the near future of the tumor.

Hybrid modeling of an audio signal based on 1-D Wold decomposition

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Abstract—- This paper presents a hybrid model which is applicable to a wide variety of unidimensional signals like speech and more complex audio signals. We propose a new criterion for an optimal reconstruction of an unidimensional signal based on Wold-like decomposition of the stochastic processes. This decomposition in the case 1D implies two mutually orthogonal parts: a purely indeterministic part and a deterministic part, which can be modeled respectively by an autoregressive model and by a harmonic model. The problem to which we answer is the identification and the separation of the two parts, by a new criterion which combines the quality and the parsimony of the parametric representations. Both analytical and experimental results show that the deterministic part and completely nondeterministic components should be parametrized separately. The model is very efficient in terms of the numbers of parameters used in the reconstruction of the original signal.

The Lucas optimal growth model on finite horizon

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Abstract—In this paper the Lucas optimal growth of the human capital and consumption is analyzed on finite horizon. The main purpose is the approximation of the optimal human capital and consumption evolution on infinite horizon by the finite case which can be numerically computed.

Finding the solutions of nonlinear equation systems from an interval

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Abstract—The paper describes an algorithm that determines the solutions of a n-dimensional nonlinear equation system within a given interval. The result is based on Semenov algorithm that isolates the solutions and improves upon it by introducing Kantorovich existence criterion. In Semenov algorithm the existence of the solution is decided by applying Newton method on each interval containing at most one solution. This article improves and completes the Semenov algorithm by determining the start iteration for each solution. With the computed start iteration the Newton method is applied to determine the solution with the precision ". The Kantorovich error function E(k) is also computed for each iteration k. The paper contains numerical experiments.

Ulam-Hyers stability of difference equations

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Abstract. In this paper we study the Ulam-Hyers stability of a k-order difference equation, in terms of weakly Picard operator theory. Some example are given.

Multivalued Picard operators and applications

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Abstract. The purpose of this paper is to present several results for multivalued Picard operators and to give some applications in the mathematics of fractals.

Semi Linear Singularly Perturbed Boundary Value Problem Using Multi-Region FDM : High Precision Calculation

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Abstract. In this paper a technique is described for determining high order FDM algorithms for the semi linear differential equation. It is shown that by using these algorithms together with the multi region FDM process, accuracies in the range of 10^{-20} may be achieved for the singularly perturbed boundary value problem representing an extension of ~14 orders of magnitude over current techniques.

An optimal collocation-type method for the computation of an approximate polynomial solution of some differential equations with application in economy

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Abstract. We consider the nonlinear problem consisting of a second order differential equation together with some boundary conditions on the [a, b] interval. For this problem we propose a new optimal collocation-type method in order to compute an approximate analytical polynomial solution and we use this method in the case of two numerical examples with applications in economy.