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Contents

Abstracts

CLASSIFICATION TREES AS A TECHNIQUE FOR CREATING ANOMALY-BASED INTRUSION DETECTION SYSTEMS

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ACM Computing Classification System (1998): C.2.0.
Key words: Intrusion detection, Data mining, String metrics, Similarity coefficients.

Abstract. Intrusion detection is a critical component of security information systems. The intrusion detection process attempts to detect malicious attacks by examining various data collected during processes on the protected system. This paper examines the anomaly-based intrusion detection based on sequences of system calls. The point is to construct a model that describes normal or acceptable system activity using the classification trees approach. The created database is utilized as a basis for distinguishing the intrusive activity from the legal one using string metric algorithms. The major results of the implemented simulation experiments are presented and discussed as well.

COMPUTING WITH THE SQUARE ROOT OF NOT

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ACM Computing Classification System (1998): B6.1, F1.1, G2.1.
Key words: Reversible computing, square root of NOT, discrete group.

Abstract. To the two classical reversible 1-bit logic gates, i.e. the identity gate (a.k.a. the follower) and the NOT gate (a.k.a. the inverter), we add an extra gate, the square root of NOT. Similarly, we add to the 24 classical reversible 2-bit circuits, both the square root of NOT and the controlled square root of NOT. This leads to a new kind of calculus, situated between classical reversible computing and quantum computing.

ON SOME MODIFICATIONS OF THE NEKRASSOV METHOD FOR NUMERICAL SOLUTION OF LINEAR SYSTEMS OF EQUATIONS*

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ACM Computing Classification System (1998): G.1.3.
Key words: Solving linear systems of equations, Jacobi method, Richardson method, Nekrassov method, Chebyshev's acceleration factors, pseudocode.
* This paper is partly supported by project IS–M–4 of Department for Scientific Research, Paisii Hilendarski University of Plovdiv.

Abstract. A modification of the Nekrassov method for finding a solution of a linear system of algebraic equations is given and a numerical example is shown.

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OPERATIONAL METHODS IN THE ENVIRONMENT OF A COMPUTER ALGEBRA SYSTEM*

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Dedicated to the 75th anniversary of Professor Ivan Dimovski, Corresponding member of the Bulgarian Academy of Sciences.

ACM Computing Classification System (1998): D.4, I.1, J.2.
Key words: Operational calculus, operational method, convolution, Duhamel principle, Cauchy problem, nonlocal boundary value problem, computer algebra system, symbolic computation, numerical computation.
* This article presents the principal results of the doctoral thesis "Direct Operational Methods in the Environment of a Computer Algebra System" by Margarita Spiridonova (Institute of mathematics and Informatics, BAS), successfully defended before the Specialised Academic Council for Informatics and Mathematical Modelling on 23 March, 2009.

Abstract. The presented research is related to the operational calculus approach and its representative applications. Operational methods are considered, as well as their program implementation using the computer algebra system Mathematica. The Heaviside algorithm for solving Cauchy's problems for linear ordinary differential equations with constant coefficients is considered in the context of the Heaviside-Mikusiński operational calculus. The program implementation of the algorithm is described and illustrative examples are given. An extension of the Heaviside algorithm, developed by I. Dimovski and S. Grozdev, is used for finding periodic solutions of linear ordinary differential equations with constant coefficients both in the non-resonance and in the resonance cases. The features of its program implementation are described and examples are given. An operational method for solving local and nonlocal boundary value problems for some equations of the mathematical physics (the heat equation, the wave equation and the equation of a free supported beam) is developed and the capabilities of the corresponding program packages for solving those problems are described. A comparison with other methods for solving the same types of problems is included and the advantages of the operational methods are marked.

The paper presents the principal results of the author's doctoral thesis [29]. Since the most important common feature of the considered operational calculi is their immediate approach to finding solutions of initial and boundary value problems, in [29] they are called direct operational methods.

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DEVELOPMENT AND IMPLEMENTATION OF NURBS MODELS OF QUADRATIC CURVES AND SURFACES*

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ACM Computing Classification System (1998): I.3.5.
Key words: Computer graphics, geometric modeling, 3D graphic systems, curves, surfaces, NURBS.

* This article presents the principal results of the doctoral thesis "Development and Implementation of NURBS Models of Quadratic Curves and Surfaces" by Emiliyan G. Petkov (St. Cyril and St. Methodius University of Veliko Tarnovo), successfully defended before the Specialised Academic Council for Informatics and Mathematical Modelling on 1 December, 2008.

Abstract. This article goes into the development of NURBS models of quadratic curves and surfaces. Curves and surfaces which could be represented by one general equation (one for the curves and one for the surfaces) are addressed. The research examines the curves: ellipse, parabola and hyperbola, the surfaces: ellipsoid, paraboloid, hyperboloid, double hyperboloid, hyperbolic paraboloid and cone, and the cylinders: elliptic, parabolic and hyperbolic. Many real objects which have to be modeled in 3D applications possess specific features. Because of this these geometric objects have been chosen. Using the NURBS models presented here, specialized software modules (plug-ins) have been developed for a 3D graphic system. An analysis of their implementation and the primitives they create has been performed.