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Abstracts

SEARCH FOR WIEFERICH PRIMES THROUGH THE USE OF PERIODIC BINARY STRINGS

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ACM Computing Classification System (1998): I.1.4, J.2.
Key words: Wieferich prime, periodic bit string, distributed computing.

Abstract. The result of the distributed computing project Wieferich@Home is presented: the binary periodic numbers of bit pseudo-length $j \leq 3500$ obtained by replication of a bit string of bit pseudo-length $k \leq 24$ and increased by one are Wieferich primes only for the cases of 1092 or 3510.

AN IMPROVEMENT TO THE ACHIEVEMENT OF THE GRIESMER BOUND *

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ACM Computing Classification System (1998): E.4.
Key words: Linear codes, Griesmer bound, projective geometry.

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Abstract. We denoted by $n_q(k,d)$, the smallest value of n for which an $[n,k,d]_q$ code exists for given q,k,d. Since $n_q(k,d) = g_q(k,d)$ for all $d \geq d_k + 1$ for $q \geq k \geq 3$, it is a natural question whether the Griesmer bound is attained or not for $d = d_k$, where $g_q(k,d) = \sum_{i=0}^{k-1} \lceil d/q^i \rceil$, $d_k = (k-2)q^{k-1} - (k-1)q^{k-2}$. It was shown by Dodunekov [2] and Maruta [9], [10] that there is no $[g_q(k,d_k), k, d_k]_q$ code for $q \geq k$, $k = 3,4,5$ and for $q \geq 2k-3$, $k \geq 6$. The purpose of this paper is to determine $n_q(k,d)$ for $d = d_k$ as $n_q(k,d) = g_q(k,d) + 1$ for $q \geq k$ with $3 \leq k \leq 8$ except for $(k,q) = (7,7)$, $(8,8)$, $(8,9)$.

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APPROXIMATING THE MAXMIN AND MINMAX AREA TRIANGULATIONS USING ANGULAR CONSTRAINTS *

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ACM Computing Classification System (1998): I.3.5.
Key words: Computational geometry, triangulation, planar point set, angle restricted triangulation, approximation, Delauney triangulation.

* A preliminary version of this paper was presented at XI Encuentros de Geometría Computacional, Santander, Spain, June 2005.

Abstract. We consider sets of points in the two-dimensional Euclidean plane. For a planar point set in general position, i.e. no three points collinear, a triangulation is a maximal set of non-intersecting straight line segments with vertices in the given points. These segments, called edges, subdivide the convex hull of the set into triangular regions called faces or simply triangles. We study two triangulations that optimize the area of the individual triangles: MaxMin and MinMax area triangulation. MaxMin area triangulation is the triangulation that maximizes the area of the smallest area triangle in the triangulation over all possible triangulations of the given point set. Similarly, MinMax area triangulation is the one that minimizes the area of the largest area triangle over all possible triangulations of the point set. For a point set in convex position there are $O(n^2 \log n)$ time and $O(n^2)$ space algorithms that compute these two optimal area triangulations. No polynomial time algorithm is known for the general case. In this paper we present an approach to approximation of the MaxMin and MinMax area triangulations of a general point set. The algorithm, based on angular constraints and perfect matchings between triangulations, runs in $O(n^3)$ time and $O(n^2)$ space. We determine the approximation factors as functions of the minimal angles in the optimal (unknown) triangulation and the approximating one.

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QUADRATIC TIME COMPUTABLE INSTANCES OF MAXMIN AND MINMAX AREA TRIANGULATIONS OF CONVEX POLYGONS *

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ACM Computing Classification System (1998): I.3.5.
Key words: Computational geometry, triangulation, convex polygon, dynamic programming.

* Preliminary version of this paper was presented at XII Encuentros de Geometría Computacional, Valladolid, Spain, June 2007.

Abstract. We consider the problems of finding two optimal triangulations of a convex polygon: MaxMin area and MinMax area. These are the triangulations that maximize the area of the smallest area triangle in a triangulation, and respectively minimize the area of the largest area triangle in a triangulation, over all possible triangulations. The problem was originally solved by Klincsek by dynamic programming in cubic time [2]. Later, Keil and Vassilev devised an algorithm that runs in $O(n^2 \log n)$ time [1]. In this paper we describe new geometric findings on the structure of MaxMin and MinMax Area triangulations of convex polygons in two dimensions and their algorithmic implications. We improve the algorithm's running time to quadratic for large classes of convex polygons. We also present experimental results on MaxMin area triangulation.

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EXTENSION OF THE C-XSC LIBRARY WITH SCALAR PRODUCTS WITH SELECTABLE ACCURACY

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ACM Computing Classification System (1998): G.1.0, G.4.
Key words: DotK algorithm, error-free transformations, C-XSC, scalar products, long accumulator, K-fold accuracy.

Abstract. The C++ class library C-XSC for scientific computing has been extended with the possibility to compute scalar products with selectable accuracy in version 2.3.0. In previous versions, scalar products have always been computed exactly with the help of the so-called long accumulator. Additionally, optimized floating point computation of matrix and vector operations using BLAS-routines are added in C-XSC version 2.4.0. In this article the algorithms used and their implementations, as well as some potential pitfalls in the compilation, are described in more detail. Additionally, the theoretical background of the employed DotK algorithm and the necessary modifications of the concrete implementation in C-XSC are briefly explained. Run-time tests and numerical examples are presented as well.

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TEACHING MATERIALS REPOSITORY*

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ACM Computing Classification System (1998): K.3.
Key words: Repository, Gaming, Semantic Web.

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Abstract. The paper presents results from the development of a methodology and corresponding software tools for building an academic repository. The repository was filled up with gaming material. The repository architecture and key features of the search engine are discussed. The emphasis falls on solutions of the large set of problems concerning the development of proper mechanisms for semantics-based search in a digital repository.

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COMPUTER NETWORKS SECURITY MODELS
*A New Approach for Denial-of-Services Attacks Mitigation**

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ACM Computing Classification System (1998): C.2.0.
Key words: Network security, denial-of-services, pattern-based defense mechanism.

* This article presents the principal results of the doctoral thesis "Computers Networks Defending Models" by Tsvetomir Tsvetanov (St. K. Ohridski University of Sofia), successfully defended before the Specialised Academic Council for Informatics and Mathematical Modelling on 25 May, 2009.

Abstract. Computer networks are a critical factor for the performance of a modern company. Managing networks is as important as managing any other aspect of the company's performance and security. There are many tools and appliances for monitoring the traffic and analyzing the network flow security. They use different approaches and rely on a variety of characteristics of the network flows. Network researchers are still working on a common approach for security baselining that might enable early watch alerts. This research focuses on the network security models, particularly the Denial-of-Services (DoS) attacks mitigation, based on a network flow analysis using the flows measurements and the theory of Markov models. The content of the paper comprises the essentials of the author's doctoral thesis.