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Stegaroiu, Carina-Elena

"Constantin Brâncuşi " University of Târgu Jiu, Faculty of Economic Sciences

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Carina-Elena STEGĂROIU
"Constantin Brâncuşi " University of Târgu Jiu
Faculty of Economic Sciences
Târgu Jiu, 24, Victoriei Street, Gorj, Romania
carinastegaroiu@yahoo.com
Phone number +40766400504

Abstract: The submitted paper is intended to revolutionize the handling methods of credit sheets and the means of collecting budgetary incomes, on one hand, and to allow operators to verify in real time the happening and recording of an economical phenomenon in the area of credit ordination through the help of inserting rare matrix in the mathematical designs of complex, physical systems of large measurements, that necessitate as an efficient solution the use of rare matrix calculus. The suggested facilities are based on the "**The model of administration in public activity** ", where one can notice that the analysis of complex systems like: technological installations, economical or industrial systems, leads to systems of algebraic linear equations with thousands of equations that the current operating systems cannot handle in terms of memory status and duration.

Keywords: *technological installations, economical or industrial systems, rare matrix, linear programming, mathematical model,* interconnection

INTRODUCTION

Specialists of various fields have been, are and will be faced with the permanent resolution of the mathematical models that describe the behavior of various physical systems. Modeling these systems lead to the physical achievement of mathematical models which either directly, through modeling, or the method involves solving algebraic systems of linear equations or linear programming problems whose coefficients matrix is rare (sparse) in that report the number of items nenule is very small. From the practice should be noted that the analysis of complex systems as the technological installations, industrial and economic systems, leading to mathematical models of large systems involving linear algebraic equations with thousands of equations to solve their current computers are limited in terms of storage capacity and computing time. In practice, mathematical models of real processes involving large numbers of variables and restrictions which are rare phenomenon (sparsity), namely poor interconnection of their components. Taking into account the phenomenon of rarity provide a new kind of highly efficient analysis of large compared with that offered by theory ranked systems with distributed information and methods of decomposition. Some of the most relevant physical systems described using matrices rare show you the following.

STRUCTURE RESEARCH

In the analysis of management will seek to identify ways of processing data relating to the technical management matrices rare.

In general a matrix (n, ,n) - dimensional is rare that contains a small number of elements nenule, τ, ie $\tau << n^2$. Quantitatively rare matrices are characterized by the number of) called density matrix. In currentτ d= $\tau / (n^2 - \tau)$ items nenule and the void, applications meet with matrix densities between 0,15% and 3%.

Definition 1. *A square matrix (n, n) - Dimensional is rare that with increasing growth in the τ pătratice is below one, ie τnumber of items nenule* $\tau < n^{1+k}$, $0 \le k < 1$.

Null elements of a matrix are classified as rare zeros and numeric topological zeros. All zerourile topological numbers are zeros. It is possible that some numerical zeros to be treated as nenule elements, which are considered nenule topology.

A nesingulară **A** matrix can be expressed as the product of two factors matrix **L** and **U**, where **L** is lower triangular and **U** upper triangular, with the main diagonal equal to unity.

Definition 2. A matrix nesingulară **A matrix is perfect if you remove** all items from zero to match zero elements in **A** the factors **L** and **U.** All matrices rare nesingulare can be transformed into a perfect matrix elimination by considering some numerical zeroes as topological nezerouri. These elements provide a matrix filling rare in a process of elimination. By reordering the lines and columns of a matrix can be reduced rare filling, maintaining as much as possible matrix structure rare in the removal process. So an effective matrix calculation involving rare considering the necessity of special storage methods and ordering.

Traditional methods of calculation matrix, frequently used in practice, as **LU** factorization, reverse, solving linear systems are reviewed and revised by optical matrices rare to adapt them to solve big problems. Matrices have a rare behavior that differs radically from that of dense matrices. A matrix factorization requires only in rare n^{1+2k} operation, and only in reverse n^{2+k}. Since k <1 matrices rare for both factorization and reverse ad less than ^{3} n operations, the same calculations required for dense matrix. Since $n^{1+2k} < n^{2+k} < n^3$, factorization that involves fewer operations than reversing what makes solving linear systems to be used factorization. Dense matrices or factorizate can be reversed by the method of Strassen requiring n operations. However grade rare matrices with k <0,904 calculation techniques rare matrix factorization provides for a superior. Similarly, techniques for calculating matrix rare offers a better way inversării matrices whenever k <0,807. Special methods factorization and inversion of a matrix rare, so a default resolution of linear matrix coefficients rare are treated in the following chapters.

Also in the following chapters are presented applications of techniques for calculating matrix rare in resolving some issues raised by the best of complex systems, solving that can not be conceived without the use of computers.

Although it is difficult to provide an exhaustive bibliography on matrices rare, I highlight the most important works.

Using matrices to describe natural systems. The purpose of this chapter is to illustrate the rare matrices in mathematical models of physical systems, large complex. These models are described with matrices rare showing weak interconnection between the large systems. Generally recognized view that the current theory of large systems is insufficiently developed, had its own techniques to solve fundamental problems, but adapting certain principles and techniques from other fields such as the decomposition and coordination of mathematical programming. Methods and techniques for calculating matrix rare applied systems analysis and synthesis of large lead to the development of new methods and efficient algorithms, based on their structure and connectivity. The matrices rare in mathematical models of natural systems analysis is remarkable in electric networks, systems, power distribution, networks fluid, mechanical structures, transport, economic systems, social issues, etc. geodesy and meteorology. Addressing efficiency of these models require the use of techniques for calculating matrix rare.

Electric Networks. Introduce this scope, because the electrical network analysis matrix method is simple and eloquent perceived allowing concrete explanation of abstract concepts in modeling matrix.

Analysis of a electric currents by calculating the edge network and terminals at these tensions lies in making a lot of equations that describe the behavior of the network, and resolve them. The most important methods for the formulation of these equations are equations on nodes and equations on loop. Formulation of equations that describe the behavior of a network consists of writing equations local current-voltage on the sides and the global equations, the topological structure of the network. Equations for local networks where resistive, linear time invariant and are shaped by the potential method nodes are:

$$\mathbf{G}_k\,\mathbf{u}_k + \mathbf{i}_{sk} - \mathbf{G}_k\,\mathbf{u}_{sk} = -\mathbf{i}_{sk}$$

For an electrical network with n nodes and l edges, local equations can be written matrix for n-1 nodes as follows:

$$\mathbf{Gu} = -\mathbf{i}_{sk} \qquad \textbf{(1)}$$

where G is conductanțelor with matrix diag (G1, G2, ..., GB) matrix conductanțelor side connected to the same node, $G_{jk} = G_{kj}$ are conductanțele side of the nodes k and j, **i,** $\mathbf{i}_{sk}$ and **u** are the vectors corresponding to the intensity of short circuit currents sources the sides and voltage nodes. Global equations based on Kirchhoff's theorems;

K1. Algebraic sum of the currents injected loop is null and void.

K2. Algebraic sum of the voltage falls over a loop is null and void.

Incidence matrix-side nodes, **A**, whose number of lines and columns, is equal to the number of independent nodes, and the sides of the network is defined as:

$$a_{ij} = \begin{cases} 1, \text{if the incidence of side j is the node i and the exit node} \\ 0, \text{if side j side if not the incidence of node i} \\ -1, \text{if the incidence of side j is the node and enter the node} \end{cases}$$

With this theorem is K1: **Ai=0.**

Matrices incidence tree-coarbore. A subgraf conex, whose number of sides (box) is one less than the total number of nodes, defines a tree of the graph. Complementary sides side define coarborele tree graph. Reordonând nodes, the incidence matrix-side nodes can be particionisati $\mathbf{A}=[\mathbf{A}_a \vdots \mathbf{A}_c]$, corresponding incidence matrices tree-coarbore. $\mathbf{A}_a$ corresponding Submatricea tree is square and nesingulară.

Incidence matrix-side loop. A loop consists of a number of sides of any tree, but the one and only one is called a loop coarborelui fundamental. In a graph loops are fundamental to the choice of initial tree. Since each loop contains fundamental one side of coarborelui number is equal to the number of sides of coarborelui.

Loops are described by the fundamental matrix incidence side-loop, **B,** with the b corresponding loop *i* and side *j*, defined as:

$$\text{b}_{\text{ij}}= \begin{cases} \text{if j side is if the loop and both have the same orientation} \\ \text{if j side loop and is not} \\ \text{if j belongs loop side and i do not have the same orientation} \end{cases}$$

With this theorem is K2: **Bu** = **0**. Matrix **B** may be a corresponding partition tree in $\mathbf{B}=[\mathbf{B}_a \vdots \mathbf{B}_c]=[\mathbf{B}_a \vdots \mathbf{I}]$. The link between the incidence matrix is $\mathbf{B}_a^T=-\mathbf{A}_a^{-1}\mathbf{A}_a$.

Equations on the electrical network nodes.A power network with n +1 nodes and b sides. Taking a bow reference tensions side network can be expressed in terms of potential node to node of reference, according to the relationship $\mathbf{u}=\mathbf{A}^T\mathbf{e}$ is, where is the vector potential nodes. From $\mathbf{Ai} = \mathbf{0}$ and the relationship (1) follows $\mathbf{AGA}^T\mathbf{e} + \mathbf{Ai}_s - \mathbf{Agu}_s = \mathbf{0}$ sau $\mathbf{Ye} = \mathbf{Agu}_s - \mathbf{Ai}_s$;

(2) where $\mathbf{Y} = \mathbf{AGA}^T$ is matrix for the admission of nodes. Solving system (2), equations known as the nodes, to obtain potential nodes to be calculated tensions sides.

In general matrix **Y** is symmetric, and diagonal elements y_{ii} are obtained by total conductanțelor all sides connected to the node *i*, and the summary was obtained by conductanțelor all sides of the nodes *i* and *j,* the sign changed. The total number of elements of nenule **Y** matrix is n+2b', where *n* is the number of independent nodes and *b'* side number connected them. Density matrix for the admission of nodes, ie the number of void items and the total number of elements is d_y= n+2b')/n^2. Thus for a network with n =1000, b'=1500, d_y= 0,004, ie **Y** matrix on each line has only four elements nenule. In practice, the number of sides connected nodes employed is proportionate to the number of nodes, ie b'= αn. So the density matrix **Y** is $d_y = (1+2\alpha)/n$, which shows that $d_y \rightarrow 0$, the number of nodes increases. An important property of matrix **Y** is the admission that for any given network density d_y depends only on the network graph, ie the number of nodes and edges, so it is a constant.

The loop equations of electrical networks. A power network with n +1 nodes and b sides for the current-voltage relationship is:

$$\mathbf{R}_k\mathbf{i}_k - \mathbf{R}_k\mathbf{i}_{sk} = \mathbf{u}_l$$

Matrix equations of the local network are:

$$\mathbf{Ri} = \mathbf{u}_l \qquad \textbf{(3)}$$

where **R** is the matrix with resistances loops diag **(R1, R2, Rb ...)** - the side of loop resistances, $R_{jk} = R_{kj}$ - resistance common side loops *j, k, i*-column matrix of the current cyclical loops and $\mathbf{u}_l$ - matrix tension electromotive the loop. Considering one for each loop current, the currents sides can be expressed in terms of cyclical $\mathbf{i}_c$ and currents of the loops $\mathbf{i} = \mathbf{B}^T\mathbf{i}_c$

and

$\mathbf{i} = \mathbf{B}^T\mathbf{i}_c$ resulting

$$\mathbf{BR\,B}^T\,\mathbf{i}_c + \mathbf{Bu}_s - \mathbf{BRi}_s = \mathbf{0}, \text{ sau } \mathbf{Zi}_c = \mathbf{BRi}_s - \mathbf{Bu}_s \quad (4)$$

where $\mathbf{Z} = \mathbf{BR\,B}^T$ is a matrix of impedance loops. Solving system (4) known as the loop equations, to obtain currents of cyclic loops, which is calculated currents sides.

CONCLUSIONS

In general matrix $\mathbf{Z}$ is symmetrical, the diagonal z_{ii} are obtained by total resistances all sides and loop *i*, and the z_{ij} are obtained by total common side resistances loops *i* and *j* with the plus sign if the tide cyclic loops of the two sides is the same in common and minus sign otherwise. The total number of elements of the matrix nenule $\mathbf{Z}$ is equal to the number of loops, b-n, plus twice the number of pairs of adjacent loops, 2p. The density matrix of impedance loops is $d_z = (b-n+2p)/(b-n)^2$. For a given network, the density matrix $\mathbf{Z}$ depends on the initial choice of loops.

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