INCURSIVITY OPERATIONAL DISPLAY

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Abstract

Description of the Operational Graphs (= Op.G.) which is a graphical synoptical methodolgy of exhibiting the operational structures of every convolution of any Systems with their Entering Flows in order to elaborate the Functional Result's Flows.
Consequently we use these (Op.G.) to discover the deep intrinsic Architectures of the Recursivity's and Incursivity's Algorithms. From this way of proceeding it will become obvious for exploring the specific advantages of the Incursivity's Procedures about the improvement of the Stability of the Behaviour of the Critical Systems.
By means of this communication we hope to convince about the power, the accuracy and the ease of the (Op.G.)-methodology and besides to show the self adjusting power of the incursivity's processes.

Keywords: Operational Graphs , Convolution , Recursivity , Incursivity , Multidimensional Transformations

1. Presentation of the (OP.G.)-Methodology

This is a **codified Cartography** for pointing up the circulations and modifications of **Flows** as a result of the **Operators-Works**, what translate the technological convolutions. It is a synoptcal tool for the drawing of the flows-dynamics. **(Fig1)**

1-1. Components of the (Op.G.) Method

The components of (Op.G.) are: the nodes and edges __ the operators __the flows
1.1.1. NODES and EDGES: the geometrical elements of the Net- stuctures.The nodes are the extremities of each edge
Edges drive the flows through the operators or between 2 nodes.
Nodes are the spots or gates where the flows have to cross. Each node may realize the both following functions; when the flows are coming into the node it is a sink-node .When the flows are going away from the node it is a source-node
1.1.2. FLOWS: every signal or any kind of matter in motion through the edges and in transformation in the operators. They stream throughout the Graphs and put thelm in activity: at the enter - gates we inject the data-flows and at the exit - gates we collect the result- flows.
1.1.3. Operators: situated on the edges,they are the working components of (Op.G.)
They transform the flows for realizing the required convolutions (or operations).
They possess a set of sources nodes as enter gates and a set of sink nodes as exit gates.
There are both essential kinds of operators **(Fig2)**
1.1.3.a. Transformators for activating the mathematical and logical operations.
They elaborate the Gains or the Response functions of each systems **(Fig3)**
1.1.3.b. the Translators for moving the flows from the enter addresses into the exit addresses. They have addresses-brackets and locating points. (F4) We may consider these last ones like generalized Z transformations.
1.1.3.c. the Compoud Operators: They simultaneously accomplish the both former depicted functions. Consequently they depict the actual behaviour of every under-system
They allow to model the whole work of the Convolutions

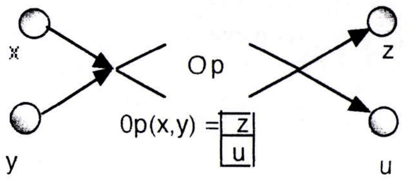


Fig1 Operational Graph

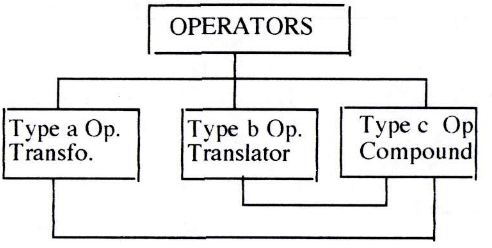


Fig2 Operators partition

1.1.3.d. Hierarchical Scale of the Operators:
(0°-grade) operators: realize the primary operations like: the agebrical sums,
the multiplications, the power elevations, the logical comparators.
the (one address) operators (= for reading or writing in matrices) They are the basic activators of every operator of higher grade.
Every (1°-grade)operator drives the activation and management of (0°-grade)operators (= the components of this (1°-grade Op.))
The operators of(p°-grade) coordinate the activation of their components of (p-k)°grade
where: $p \geq k \geq 1$
Determination of the grade of an operator: add a unit at the highest grade of his under operators.

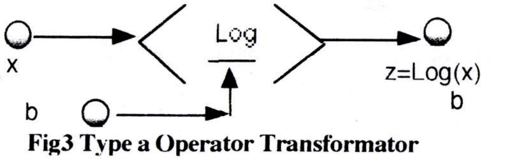


Fig3 Type a Operator Transformator

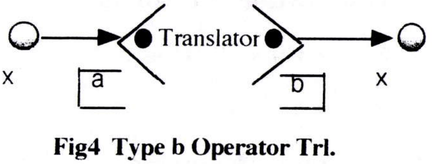


Fig4 Type b Operator Trl.

1-2 GRAPHICAL TRANSLATION of the RELATIONS

1.2.1. The relation: $S = P1 + P2 = (a^{\alpha} . b^{\beta}) + (c^{\gamma} . d^{\delta})$ is presented on (**Fig5**)
It is an obvious indication of the paths of the flows throughout this (1°grade)operator.

1.2.2. Inversion Procrdure: on (**Fig5**) we proceed the inversion of the path: a->S.
into the path: S->a ; the result is displaid on (**Fig6**).
The inversion is gradually performed at each met node along this inverted path and is differentiated in accordance with the nodal kind.
1.2.2. a. At a sum-node: change the sign of every convergent transmittance which does not belong to the inverted path
1.2.2.b. At a multiplicator node: change the sign of the exponents of the power of every convergent transmittance which does not belong to the inverted path
1.2.2. c. Along the whole inverted path: inverse the exponent of each met Op. along this inverted
path.
We may remark the easiness and the calculating compactness of the inversion-procedure because we only need 2 different inversion procedures, adapted with the kind of the met node along the inverted path.

1.2.3. Vectorialisation of the Scalar Relations: on (**Fig 7**) we discover the

vectorialization of the algorithm on (**Fig5**)
Specificities of this procedure: the scalar structure is kept; the vectorial character of the nodes is pointed out by transverse strokes; number of strokes is in accordance with the vectorial grade. Hierarchy of the parametrical incrementation is indicated by the mutiplicity of the arouws in correlation with the sweeping frequency . (= sweeping harmonics for incrementations).

1.2.4. Loops: they translate the Feed Back effects and consequently they permit any way of regulation. **(Fig8)**

Loops taking off or loops reduction: from (**Fig8**) it is possible to write: $\mathbf{y = tx + gy}$

$$\mathbf{(1\text{-}g)y = tx}$$

as a result: $\mathbf{y = tx\ (1\text{-}g)^{-1}}$

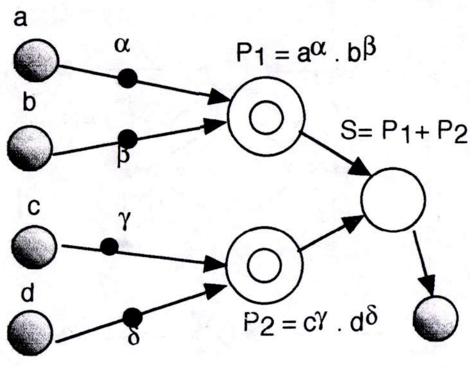


Fig5 Hierarchical structure of the (Op. G.)

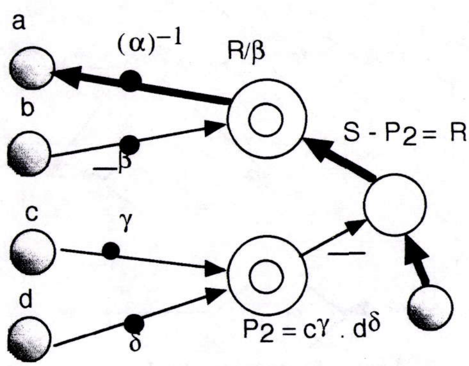


Fig6 On Fig5, Inversion of the path (a-->S) into (S-->a)

.Interpretation of this result: it is established that the sum of N runs along a loop act also as integrator (**Fig9**) or as indicial addition-operator.
Besides the result of a sum of the elements of a geometrical serie, with g like specific parameter, is also computed by use of this same formulation :

$$\mathbf{S_k = \Sigma_k (g)^k = (1\text{-}g)^{-1}}.$$

Algebraically a loop realizes a storage or an avalanche- effect because every flow entering in a loop has to run through this last one during a few times. The loop translator shows that every instantaneous flow at k^{th} run has to be tranfered to the last N^{th} time for activating the addition or the storage

Parallel loops or loops vector: On **(Fig 10)** is presented many parallel loops with different transmittances-values g_k ; it is a vectorialized geometrical serie: $S = S_l\ [\ S_k\ g_l^k\ ]$ and we accordingly use the vectorialisation of the graphical dealing to obtain a more compacted graph **(Fig 10)**.

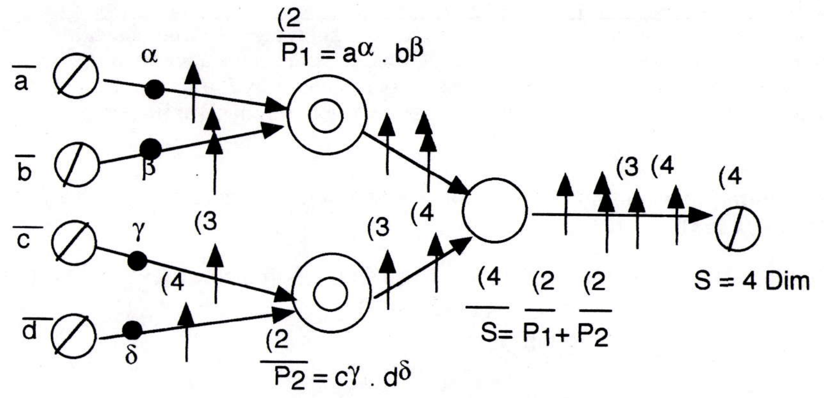


Fig7 Vectorialisation of F5

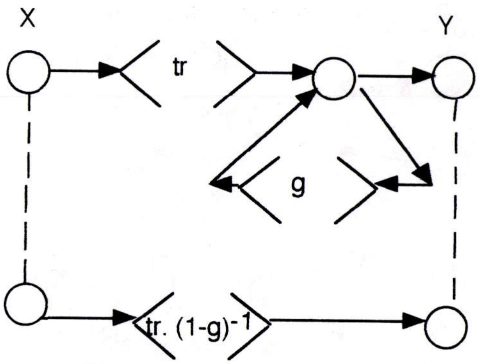


Fig8 Reduction of Loop

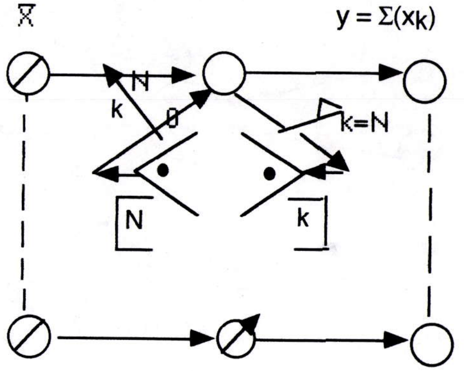
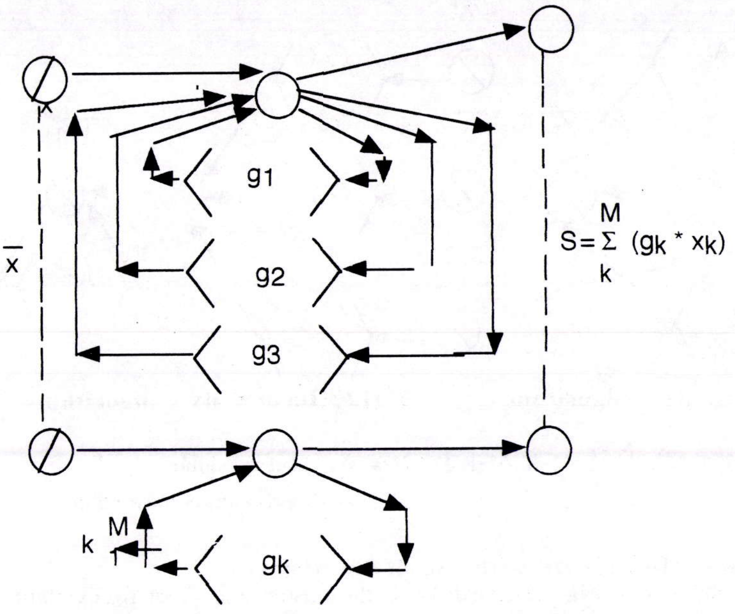


Fig9 Loop for integration



This last configuration is compacted by means of the vectorial scripture

Fig10 Parallel Loops and Loop's vector

2- Use of (Op.G.) Methodology for the Presentation of Recursivity's and Incursivity's Algorithms

2-1 Recursivity's Structures

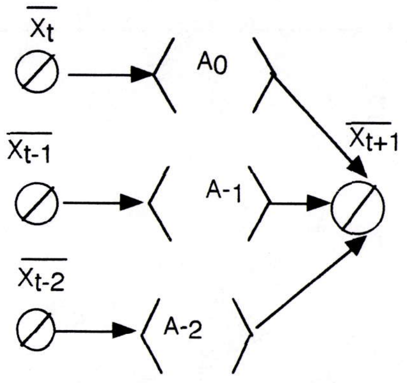
Every Recursivity must caculate for any entity X, a future value from past and present known values. In these recursivity's procedures we don't find any loop for developing a stability's improvement. During these recursivity developments we have no ability to correct the elaborated trajectory through the states of the computed variable. The incursivity structure is pictured on **(Fig11)** which displays the following relation :

$$X_{t+1} \leftarrow A_t X_t + \Sigma_K^N [A_{t-k} X_{t-k}]$$

where: X_t = present value; X_{t+1} = future value and X_{t-k} = past value

2-2 Incursivity's Structures

Every Incursivity's procedure contains some different weighted influence from the anticipated future what is instantaneously inserted in the approach policy to the real future state of the vector X.Therefore feed back loops are occuring among these incursivity patterns. The self matching power of the incursivity methodology is lying in these loops; by means of which it is possible to adjust permanently the developed progression for reaching the best plausible behaviour of the system. This way of process seems very useful when controlled systems are working out through fields with weak funtional stability. The incursiviyy's procedure is represented on **(Fig 12)**



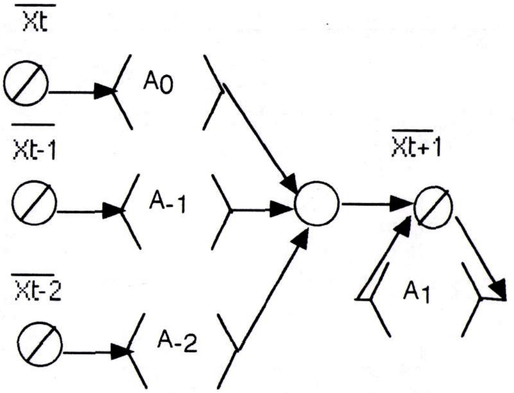


Fig11 Recursivity's algorithm **Fig12 Incursivity's algorithm**

$(1- A_{t+1})\ X_{t+1} \leftarrow \Sigma_K^N\ [A_{t-k}\ X_{t-k}]$ where: X_{t+1} future value
X_{t-k} present and past values

2.3. Introspection of Incursivity with use of the (Op.G.)

In every incursive architecture (**Fig 12**), we discover the existence of a loop for exhibiting the reflexive self action of the future value. Besides incursivity is similar to a step by step discover of the unknown value and therefore looks like a progressive forecasting based on agendas and time tables.
For this reason the matrix A_{t+1} (= forecasting matrix) contents the already gained partial informations about X_{t+1}

2.4. Vectorialisation of the Recursive and Incursive Algorithms

The use of the indicial sweepings (k and l) leads to a systematical vectorialization of the past and present: { values: X_{t-k}, X_t into a mega mixed vector $\mathbf{X}_{-N\leq t\leq 0}$
& {operators A_t . A_{t-k} into a mega mixed operator $\mathbf{A}_{-N\leq t\leq 0}$
From this way it is possible to obtain the compact figurations of Recursivity and Incursivity (**Fig 13**) & (**Fig 14**)

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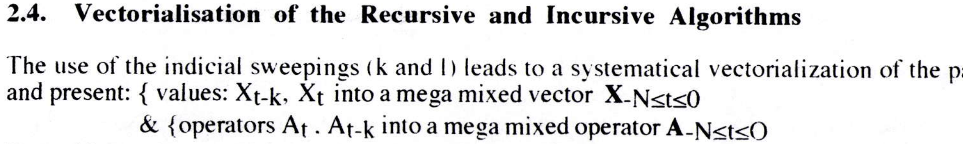

Fig13 Global vectorialisation of the Recursivity

2.5. Loops like Stabilizing Agents

The internal action of every loop helps to increase the Stability of any procedure.
What is obvious due to the fact that each loop cancels one freedom's grade of the behaviour of the depicted system.For this reason, Incursivity seems well equipped and matched for the forecasting of the behaviour of the non linear systems.

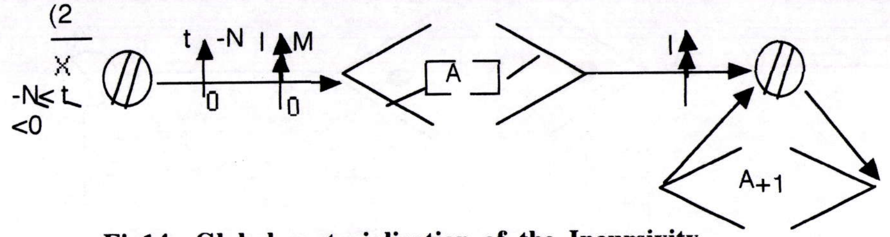

Fig14 Global vectorialisation of the Incursivity

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2.7. Structural Similarities between Incursivity and the Multidimensional Transformations

The step by step elaboration of an unknown vector by means of a progressive determination of its components occurs also in the multidimensional transformations where we leave a known state through a serie of transient mixed states accessible as a result of permutation of an old component with a new one to reach finally the new whole defined state. **(Fig 15) & (Fig6)**. The incursivity into the future from the present and the past seems a usual proceeding in any planification and also a very skill policy to avoid the surprising effects and the ugly disturbances of the whole unexpected situations.

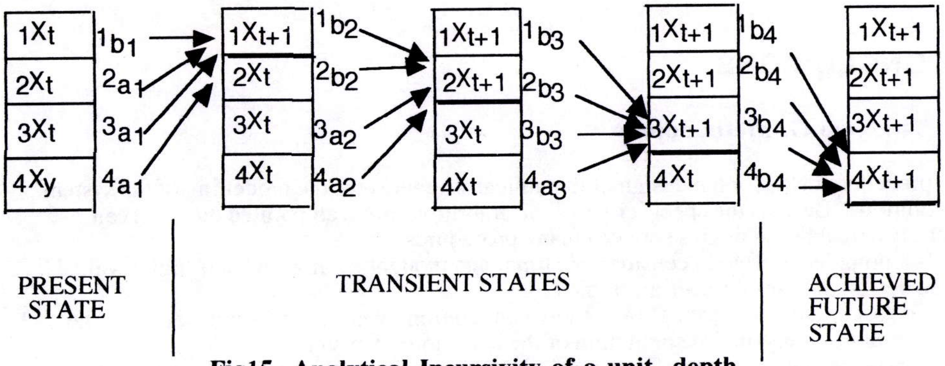

Fig15 Analytical Incursivity of a unit depth

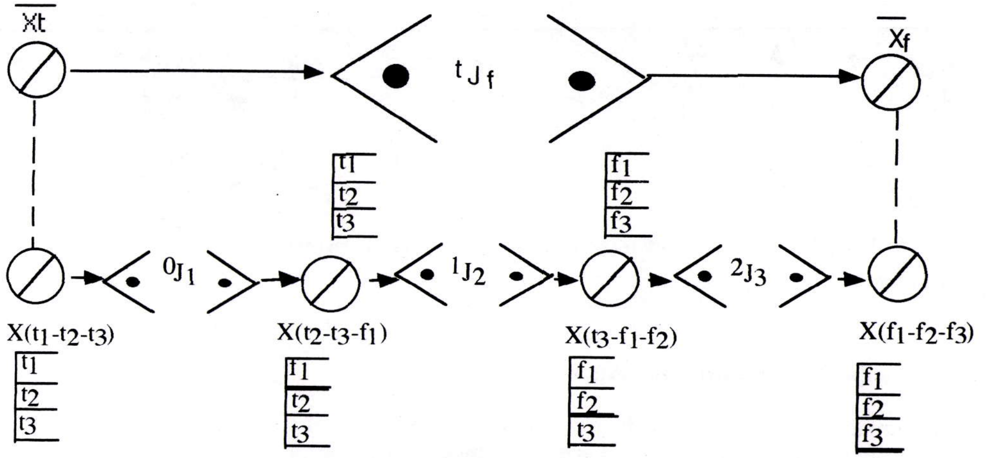

Fig16 Structure of the Fast Fourier Transformation

2.8. Entropy -Sight and Incursivity

From the comparison between Recursivity and Incursivity, it becomes obvious that every feed back loop is a necessary tool for reducing the erratic behaviour of a system; becauseany control only acts through these loops. From the introspection of the algorithmic structures of recursivity (Fig 11) and of Incursivity (Fig12), we can easily constat that Incursivity procedures operate as Entropy reductors; because they aim to attenuate the consequences of every unforeseen disturbances.

3 CONCLUSIONS

3-1 The (Op.G.)Methodology

This procedure helps for the design of dynamical structures for the modelling of the system's convolutions. Besides the specificities of the algorithms are well pointed ou, what can generally reveal the analogies between many procedures.
This last point leads often to considerable time- and thought-savings; what is highly valuable for the design of new engineering studies
The (Op.G.) modify and drive flows of any convolution; what is very appreciated for the understanding , analysis and simulation of the behaviour of systems
Their use for the presentation of the recursive and incursive procedures appears like the effective didactical tools for revealing their intrinsic specefic structures.

3-2 Incursivity and Anticipatory Algorithms

As we can discover on the operational graphs, incursivity's algorithms posses feed back informations flows from the future. Indeedthis last point is translating the system's ability to gain an intrinsic anticipatory behaviour.

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