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AI-Digital Engine of Artificial Economic and Knowledge Type by a Matsui's Progressive Loop Approach

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Abstract

Based on numbers, data, information signals, and science, humankind has developed an artificial language tools and artifacts. At intangible artifacts, we first compared ordered queuing vs. flow number methods to visualize cumulative processes for such entities as big data, and showed the anatomy (Carnott-like cycle) of ellipse-cross type at the economics(engine) vs. reliability(handle) of body map by using this progressive-loop method at GDP case in Matsui (2022). Next, we discussed a few methods and examples of virtual engines of economic and knowledge systems by Matsui's equation & ME (M-equation) approach. Finally, formulation types of AI-like matrix engine (square matrix or correlation table) and Matsui's matrix approach are graphically given at a white box of SW (middle initiative) base, and would contribute to a knowledge-based and digital society.

Keywords

Digital Engine, Ellipse Pair-Map, Progressive Loop Dynamism, Matrix Approach, Intangible Artifacts

1. Introduction

Based on numbers, data, information signals, and science, humankind has developed an artificial language tool called a computer (Sumita, 2022). In highly fluid societies, there is a need to use science and technology for digital language as an artificial body of "Copernicus perspective", which consists of man, material, money, and information-time (3M & I-time).

Using this tool, society can pursue dynamic smartness in automobiles, which are moving artificial bodies. This classic cumulative chart, which is gaining attention from a digital perspective, is used in flow number graphs in Japan (Matsui, 2014a, 2005b), and introduces to the ellipse-cross-like anatomy at the pair-map microcosm of artifacts body.

The traditional flow number graphs are classically called the "*ryudousuu*" graphs in Japanese, and are simply usable, renewal and now advancing since ODICS tools (2000). Recently, we focus on corporate robots (Matsui, 2019a, 2021a), and design one for the development of an effective language tool using Matsui's equation. We drive the autonomation of economic and knowledge types using artificial body research on pair-map creation and Matsui's equation system (Matsui, 2016, 2019b), which are the dynamics of corporate robots.

In the virtual world, we develop a pair-map style management robot for cock-pit-type autonomous operation that surpasses the Diamond magazine paper by Matsui & Fujikawa (DHBR in 2005) (Matsui, 2005c), which is an application of the pair matrix notation created in the 1980s (Matsui, 2002a).

To achieve our objective, we focus on the dynamism of nested ordered entry (OE) sequences found in loop conveyors. Using a 3D microcosm system from cumulative flow number process-focused "serial rows" of artificial body pair-maps (Matsui, 2008) as a base and a matrix diagram representation of natural versus artificial bodies and science (e.g., microcosm), we focus on the development of flow number-focused serial rows of dynamic processing at a microcosm starting point, as well as the development potential of SCM (ODICS) (Matsui, 2019a; 2019b; Matsui et al., 2021) and AI matrix systems (Matsui, 2020) and GDP (Matsui, 2022b) engine to drive autonomation using progressive dynamism.

The effectiveness of this autonomation looks at problems from the traditional Taylor-style static to dynamic (cock-pit) management approaches. This is an engine "economy" vs. handle (reliability) technique in pair-map microcosms using flow number-focused progressive dynamism, and depends on the autonomous pursuit process and formulation of the maximization of the intersecting mutual product (efficiency). We also demonstrate that this microcosm of nature vs. artificial bodies is effective in cumulative processes, especially with the dissection of elliptic theory at its origin.

2. Cumulative Process View of Artificial Bodies and Matsui's Equation & M-Equation Method

2.1. Cumulative Flow Number Process of Artificial Bodies Loop and Elliptical Dynamism Dissection Method

On a planet surrounded by an artificial sea, supply-demand management has a series of isolated islands; these are being connected one after the other by ships, bridges, airplanes, and conveyors, and information from both human and materials is moving toward process and sustainability (nesting). With globalization, this economy and supply-demand management is gaining speed, with digital engines (which move with "money" energy) as transport routes and movement change from linear to non-linear systems.

The world seems to be shifting from stationary to mobile as society progresses. This begs the question of whether the speed and stability of supply and demand can be maintained on systemized conveyors "static in motion" (Matsui, 2022b). Will the coming digital age of engines enable a sustainable society that movies sequentially, that is, one that thinks and acts as it moves?

Manufacturing sites in countries such as Japan are known to use flow number graphs, as well as approximate expressions of required time, in waste (*muda*) research. In the world of empirical flow number management, Matsui's equation is widely known as 3M&I-type science, and its origin is detailed in **Figure 1,** which was introduced in the proof of renewal theory by W.S. Jewell with Little's law in classic queueing theory (Jewell, 1967; Matsui, 2014b).

Figure 1 depicts the transition from a belt conveyor to loop conveyor in the artifact world, a process in which the lot size (Q) changes from $Q > 1$ (integration) to $Q < 1$ (sharing). This loop can be viewed as a type of unloading → loading → unloading → Carnot-like dynamism (high temperature → low temperature → high temperature →), which should lead to a more efficient money energy engine.

When analyzing the flow number theory based on **Figure 1**, this loop progressive dynamism on natural versus artificial bodies may be applicable, and is effective in the dissection of ellipse pair-map phenomena of an artificial body microcosm. This method also considers the income growth and distribution theory of sustainable loop conveyor systems, and its dynamism is considered useful in the discussion. This is believed to also be the case for self-driving cars and knowledge body-based driving autonomation (self-moving) mechanisms of the future.

2.2. Matsui's Classic Queueing Equation, Flow Number Method and M-Equation Method

As in Little's law in classic queuing theory, overflows have often been ignored or

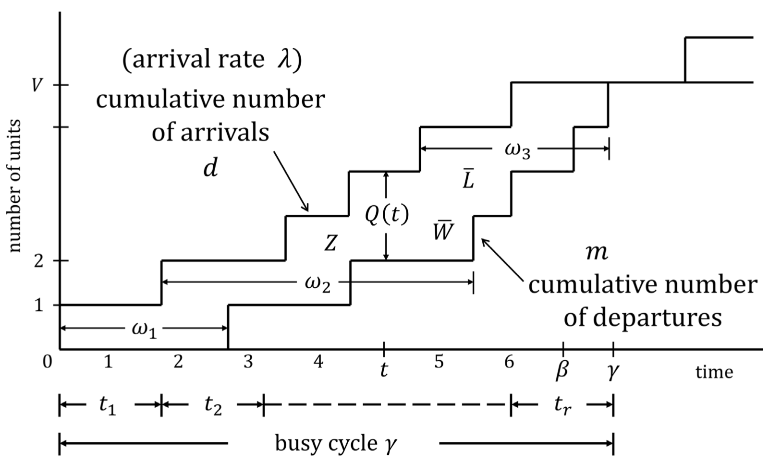

Figure 1. Cumulative processes with overflows: A queueing versus progressive view and Matsui's equation ($\bar{W} = Z\bar{L}$).

neglected in 3M&I-type processes; Figure 1 is an example of an operating cycle with an overflow. From the linear equation of overflow η and delay Δ (waste formula), Matsui's equation ($W = ZL$) is generally valid (Matsui, 1981, 2005a). Here, Z is cycle and L is quantity per produced, and W is the workload in Matsui's equation: $W = ZL$ (Matsui, 2014b, 2008).

This Matsui's equation is used as an evaluation criterion system (Z, L) on input-output relationships (d, m) of supply(m) vs demand(d) speed, but its transformation, T(DX), can be represented by cumulative process-focused visualizations, and these graphic representations can be expressed algebraically with Matsui's matrix equation (M-equation or ME) using the flow number graph (Matsui, 2002b):

$$\begin{aligned} &Ki(\text{Introduction}: I) \times Sho(\text{Development}: D) \times Ten(\text{Twist}: T) \\ &\times Ketsu(\text{Conclusion}: C) \times B(\text{Balance}) = G(\text{Goal}) \end{aligned} \tag{1}$$

With this, the whose form of Matsui's approach can be illustrated with the diagram in Figure 2. Here, *Sho* (D) corresponds to the pair matrix in our notation.

3. Flow Number-Focused Progressive Dynamism and Ellipse Pair-Map Dissection

3.1. Illustrative Example of "Economy" vs. Reliability Ellipse Intersection Using Progressive Dynamism

The intersecting ellipses theory is known in early pair-map research, but its reliability (LT, "redundancy" at entropy) could be exemplified with flow number graphs. The example outlined in Table 1 is shown as an ellipse on the left side of Figure 3; the ellipse on the right side is thought to be a virtual Euler cycle system

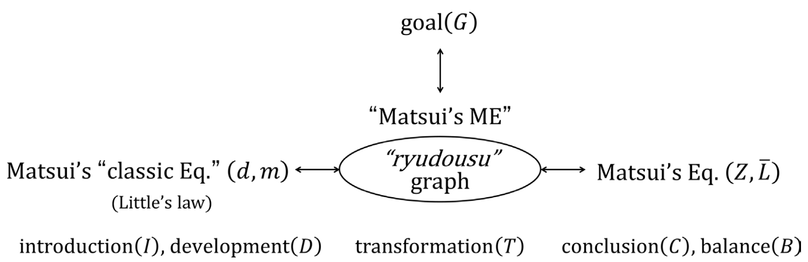

Figure 2. Outline of Matsui's equation ($W = ZL$) & ME, namely Matsui's M-equation of the types IDTC-BG and GG (Ricatti eq.)

Table 1. Example of progressive data and table for Figure 3.

date		1	2	3	4	5	6
input	value	7	6	4	3	2	1
	cumulative	7	13	17	20	22	23
output	value	1	2	3	4	6	7
	cumulative	1	3	6	10	16	23
"ryudousu"	0	6	10	11	10	6	0/43

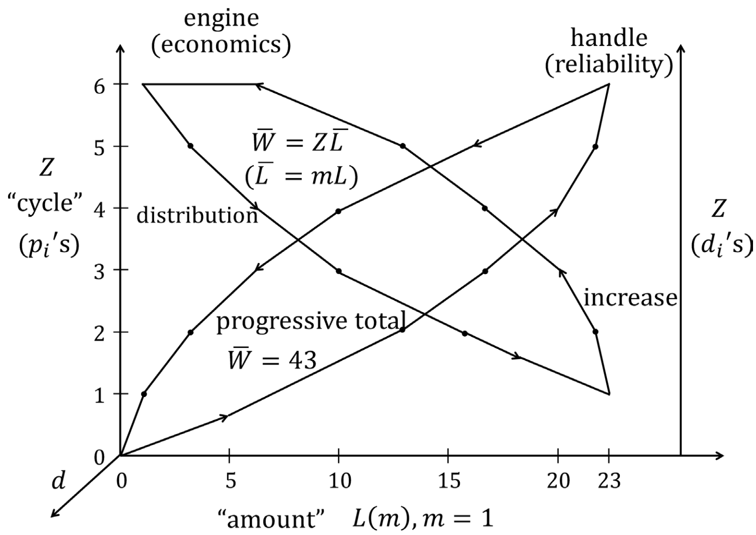

Figure 3. An economics vs. reliability dynamism at pair-map ellipse, with the "cycle" (Z):d (period) (reliability side) and (Z):p (value) (economics side).

engine. The left and right sides of these, respectively, correspond to the average and total flow time in the Job-shop scheduling theory with IE/OR.

The pair-maps of intersecting ellipses in **Figure 3** M. (Matsui, 2005b, 2008) correspond to virtual economic engines; this diagram also serves as a dissection of elliptic theory and can be considered an empirical example of it. Virtual examples of economic engines include gross domestic product (GDP) engines, distribution-based handle engines, and ODICS engines, which are effective for new inventory control methods of corporate and supply-demand systems. These are conveniently called Matsui's equation engines.

This example of **Table 1** is cited from (Matsui, 2019b) at scheduling problem.

3.2. Example of Application of Matsui's Equation to an Ellipse Pair-Map Engine

This matrix representation of **Figure 3** in **Table 1** could be easily corresponded to Matsui's M-equation or "mother" table (engine) in **Figure 4**. That is, **Table 1** above is a representation of the dissection of elliptic theory in pair map in **Figure 3** built by progressive dynamism.

In addition, using the pair matrix notation and Matsui's formulation (1), the algebraic engine and handle are expressed according to a flow number formulation example (Matsui, 2021), and the handle (reliability system) is expressed in **Figure 4**. Based on the algebraic equation solution of engine and handle, this algebraic method may be useful for autonomous driving efficiency and its improvement.

4. Engine Conversion of Knowledge-Based Artificial Intelligence (AI) Type

4.1. Example of Virtual Engine with Scheduling Type Examples

The called AI-problem is here regarded and considered as a type of data flow at

$$\overset{I}{\begin{pmatrix}1&2&3&4&6&7\\7&6&4&3&2&1\end{pmatrix}} \times \overset{D}{\begin{pmatrix}1&&&\\&1&&\\&&\ddots&\\&&&1\end{pmatrix}}$$

$$\times \overset{T}{\begin{pmatrix}(1-1)&(1-1)&\cdots&(1-1)\\&(1-1)&\cdots&(1-1)\\&&\ddots&\vdots\\&&&(1-1)\end{pmatrix}} \times \overset{C}{\begin{pmatrix}1&1&\cdots&1\\&1&\cdots&1\\&&\ddots&\vdots\\&&&1\end{pmatrix}} \times \overset{B}{\begin{pmatrix}1\\1\\\vdots\\1\end{pmatrix}} \overset{G}{\overset{\bar{W}}{=43}}$$

Figure 4. A Matsui's M-equation example and progressive total by progressive process formulation.

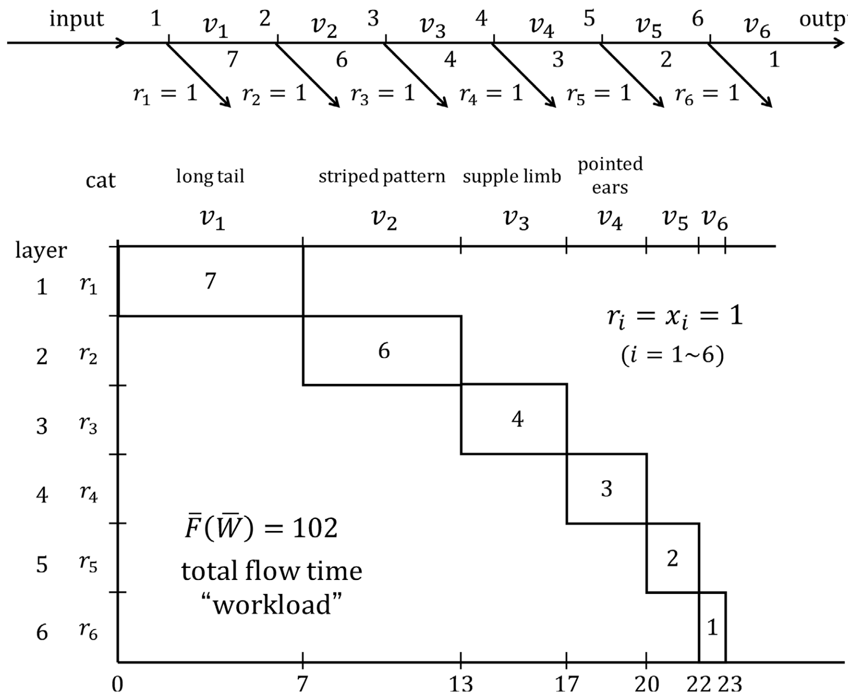

Figure 5. Progressive type graph, namely an engine type of square matrix or correlation table, of ordered-entry (upper) and artificial scheduling (lower) system. Note that the respective layers of input number are stepwise, but those of output number are constant zero except layer 6 at the cumulative graph.

material (information) handling system, and its neural network would be simulated as the flow problem of distribution center at OE(ordered-entry)-conveyor type. For example, Table 1 details a single machine ordering problem that is usually known as a simple example of a flow scheduling problem, and the dissection of elliptic theory in pair maps can be seen.

Similarly, Figure 5 is an AI-like expression of a chart used in ordering rules research, and, in the next section, we look at the flow number-focused progressive dynamism seen in Figure 3. That is, the left axis of Figure 3 (cycles) show the flow (departure) order, are corresponded in Figure 5 to the respective layers at AI-engine, and its processing rate is denoted by the ratio, r (production rate).

$$\left((\lambda_1 r_1)(\lambda_2 r_2)\cdots(\lambda_6 r_6)\right) \times \begin{pmatrix} r_1 & & & \\ & r_2 & & \\ & & \ddots & \\ & & & r_6 \end{pmatrix}$$

$$\times \begin{pmatrix} (1-1) & (1-1) & \cdots & (1-1) \\ & (1-1) & \cdots & (1-1) \\ & & \ddots & \vdots \\ & & & (1-1) \end{pmatrix} \times \begin{pmatrix} 1 & 1 & \cdots & 1 \\ & 1 & \cdots & 1 \\ & & \ddots & \vdots \\ & & & 1 \end{pmatrix} \times \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix} = \bar{F}(\bar{W})$$

Figure 6. A Matsui's M-equation (engine) example and workload of an AI-like matrix type.

4.2. AI Determinants (Engine Conversion) Using Matsui's Matrix

Now, the virtual engine in **Figure 5** could be here regarded at the two points of matrix approach. First, the respective numbers of horizontal rows and vertical columns are equivalent, and this square matrix is also near to the correlation table. Also, the AI-based flow number-focused exemplification of **Figure 5** is built using the pair matrix notation method and Matsui's formulation (Matsui, 2019b, 2020) according to flow number formulation examples (Matsui, 2021).

Also, **Figure 6** is built from simple AI determinants (Matsui, 2020) and engine conversions (Matsui, 2022a, 2022b). Additionally, the dissection of elliptic theory in pair maps can be drawn from **Figure 5** and **Figure 6**, as in **Figure 3**, and from the intersecting shape of engine (economy) and handle (reliability), the AI driving efficiency can be discussed and a yardstick can be derived for its improvement.

5. Engine Conversion of Knowledge-Based Artificial Intelligence (AI) Type

This paper first compared ordered queuing vs. flow number methods to visualize cumulative processes for such entities as big data, showed the anatomy (Carnott-like cycle) of ellipse-cross type at the economics (engine) vs. reliability (handle) of body map by using this progressive-loop method, and gave a white-box method of SW (middle initiative) base by matrix approach.

Next, we discussed a few methods and examples of virtual engines of economic and knowledge systems using Matsui's equation & ME (M-equation) approach of economic and knowledge systems. Also, formulation types of AI-like matrix engine conversion (square matrix or correlation table) and Matsui's matrix approach are graphically given at a white box of matrix type.

The usefulness of Matsui's equation and formulation method in formulating these cumulative processes is becoming clearer, and, in the digital world, is believed to be replacing traditional calculus systems of the analog world. It is also becoming clear that this will lead to mathematicalization in cumulative processes from the massive amounts of artificial intelligence (AI) big data in recent years.

This study on flow number-focused progressive dynamism represents an example of AI-like matrix engine conversion (Matsui, 2020) using the Matsui's matrix approach in artifacts science, and will likely contribute to a knowledge-based and digital society. For example, there are recently seen such the development potential as SCM (ODICS), GDP and AI engines.

Finally, the cumulative process approach of flow number and its discussions on this paper would be valuable to the forthcoming digital world. Also, Matsui's equation, its versatility, and generic equations would be useful as a digitalized base of such cock-pit management of natural vs. artificial bodies as autonomous driving. This future possibility could be demonstrated from the digital world language to the meta-verse world.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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