CIRCULAR VARIABLE WORK IN PROCESS

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Abstract

This work is focused on identifying a circular pull production control system (PPCS) and make emphasis on the presence of a stability attribute. It is an introductory paper to an extended study of macroeconomic financial stability in a physically open but systemic closed system. Previous work has been focused on achieving a balance between system failures and work in process inventory levels, under a particular risk allowance and a particular environmental scenario. This work establishes a thesis stating that a metaheuristics approach to PPCS will harvest benefits not possibly considered when optimizing a local process.

Keywords: Metaheuristics, Global optimization, Kanban, Conwip, Base Stock

1. Introduction

The opportunity addressed in this paper is raised from the possibility of achieving a robust production management system, where the systems future is actively enhanced by means of implementing elasticity on release authorizations.

We are dynamic; our work, production, consumption, transportation are only identifiable for their dynamic attribute. As such, we can better measure dynamism with frequency of events as the standard metric, the less frequent the events are, the lesser degree these events are dynamic.

Interruptions of a production system are identified, in a short-term lapse, as discontinuities in the average long-term dynamics of the system. Elaborating from this, we can make two interpretations; the first is to think of a reference time interruption as a catastrophic event in a high frequency system; the second is to believe a system of high frequency cannot experience long interruptions because it has a shorter time response.

Certainly, both attributes are true to a certain degree. Their commonality rests in being immersed in a sequential/synchronous although not coherent PPCS.

There currently exist three basic topologies for pull production control system, namely CONWIP or Constant Work In Process, KANBAN, and Base Stock PPCS [2] but these have not taken into account the circular nature of systems.

Studies have been done regarding the analysis of short-term effects and transient response on a PPCS. A critical concept for short-term analysis is a 'disaster', referring to the event of production falling below a percentile base scenario [1]. In this paper, the term jamming and jamming margin are introduced as substitutes, which are believed to be better terms, in accord with statistical analysis of dynamic systems.

Dynamic systems are, and their existence is not hindered by a disastrous event. Rather, the disaster is a particular dynamic event. In this context, this paper justifies the use of jamming as a better suited term for systems analysis, particularly so because it's referred to a dynamic one.

This paper applies a top-down approach to optimization, it has a place in supply chain management through local anti-jamming control. In order to exploit greater scale synergic opportunities, current top-down management practices must be reevaluated.

The paper is organized as follows. §2 is a background to the Kanban PCSS. §3 is information to the CONWIP PCSS. §4 is the presentation of our PCSS. §5 Conclusions summary. Five references finish this paper.

2. Kanban CONTROL

Protocol:

This is implemented by circulating cards (kanbans). The machine must have a card before it can start an operation. It can then pick raw materials out of its upstream (or input) buffer, perform the operation, attach the card to the finished part, and put it in the downstream (or output) buffer.

note- The return of a card (kanban) from the output buffer to the machine upstream resembles the use of money. The downstream forwarding of kanbans from a machine does not resemble the use of money.

INSERT Figure 1: KANBAN control. Flow of service shown in red, flow of kanbans in purple

3 Constant Work-In-Process (CONWIP) CONTROL

Protocol:

Once the parts are released, they are processed as quickly as possible until they wind up in the last buffer as finished goods. One way to view this is that the system is enveloped in a single kanban cell: Once the consumer removes a part from the finished goods inventory, the first machine in the chain is authorized to load another part.

INSERT Fig 2.- C-VARWIP control. Flow of service shown in red, flow of release authorizations in blue.

4 Circular Variable Work-In-Process (C-VARWIP) CONTROL

Visualize a closed productive system where all work is generically named "Service".

A generic service is added value, at times it is evident in an objects attributes, at times it is reflected without material substance.

Where applicable, a service need not be referenced to a material substance. This aids in defining work as a service rendered in exchange for money where presence of matter is not relevant, but the funneling of generative or degenerative energy is present in the system.

In our C-VARWIP diagram, green arrows represent the flow of –Pull- cards in the productive system just like it is used in Kanban or CONWIP, the only reference on their directionality is them being transferred conditionally on exchange for a service. What distinguishes these green cards is, they do not flow in company of the service at process termination but they flow locally in reverse direction with synchrony. Green arrows can represent how traditional money is handled; red arrows represent the flow of a service.

INSERT Fig 3.- C-VARWIP control. Flow of service shown in red, flow of release authorizations in green.

In this simple way we can visualize a closed circular system of exchange, where:

-T is the average time of the process(es) or mean processing time;

-R is the average frequency of exchange(velocity), evaluated as the reciprocal of T

We can evaluate T and R either for each service station or globally, and wherever the term money appears, it will be referring to release authorizations.

Being this a locally synchronous system of exchange, we can say R is also the velocity of money as mentioned by McConell[4]

A monetary means of evaluating average velocity, is by taking the average flow of release cards per unit time and divide by the average estimated inventory of release cards (money) prior to the release.

Static equilibrium between supply and demand is irreconcilable and non-existent, it may be a useful tool for setting targets but we must be aware that targets themselves have continuous movement. Static analysis does not regard the uncertainty principle or time-bandwidth product theorem stated by W.Heisenberg.

In a balanced linear or circular PPCS system there is a small deviation for processing time hence a small deviation for velocity but it does not necessarily reflect a stable system, a shortening of statically measured processing time is the reflection of a stable dynamic system [5].

If we are to re-engineer the system, we will find ways to increase over time, the power and frequency of the process spectrum (shorter processing time) [3] while increasing release orders for a combined effect of anti-jamming margin gain.

We may infer that the time behavior of services rendered will affect the time behavior of money. And so, reasonable judgements may be:

-money and services rendered are interdependent.

-a PPCS system may be jammed by physical or monetary means (lack of release authorizations)

Being interdependence an attribute of the system, it is likely possible to establish an anti-jamming margin gain by means of a re-engineered monetary and fiscal system, both of which influence the system as a Base Stock [2] PPCS would do.

The next step in extending our circular PPCS is to do meta-heuristicis for a closed entity by intersecting various circular PPC-subsystems, analyze its dynamics for global optimization and anti-jamming control.

INSERT Fig 4.- C-VARWIP control. Flow of service shown in red, flow of locally synchronous release authorizations not shown.

From one moment to another, the configuration of these circular intersections may change but for operations research purposes, this is not relevant. What is relevant is the identification of means of applying anti-jamming to the PPCS and thus turn it into a robust evolutionary system.

INSERT Fig 5.- Circular cash flow [5]

If we observe the model of figure 5, we may identify money extraction dynamics and consequently also that of release authorizations, marked by the letter U. Economists have named this jamming condition, economic cool down.

This brings us to money interest rates in a centrally controlled, free market. A rise in interest rates will disturb the systems homeostasis (base scenario) and extract money from it; a fall in interest rates will also disturb homeostasis but will supply an incremental amount of release orders, bringing a means of anti-jamming margin gain.

A dilemma consisting of overheating an economy or hindering development by jamming it, must be dealt with.

5. Conclusion

C-VARWIP is a top-down approach to PPCS, and by that nature, it must deal not only with service dynamics but also with money dynamics. Another source of improvement to quality of service at the work station level is, the analysis and re-engineering of the system in its proper circular dimension.

Anti-jamming is gracefully democratic, economic cool down is democratic only in heroic times because it requires an elite group of care takers / protection givers with high differential maintenance costs.

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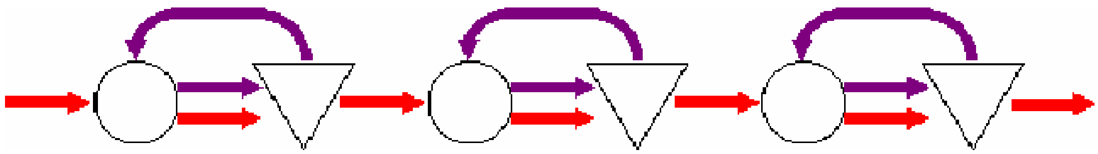

Figure 1: KANBAN control. Flow of service shown in red, flow of kanbans in purple

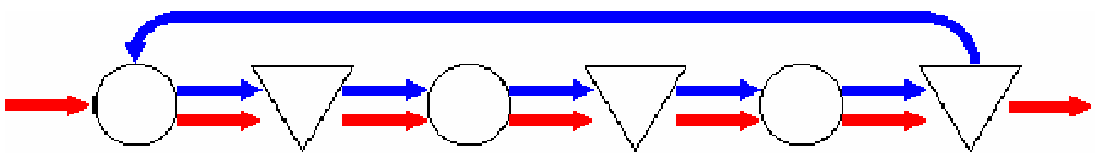

Fig 2.- C-CONWIP control. Flow of service shown in red, flow of release authorizations in blue.

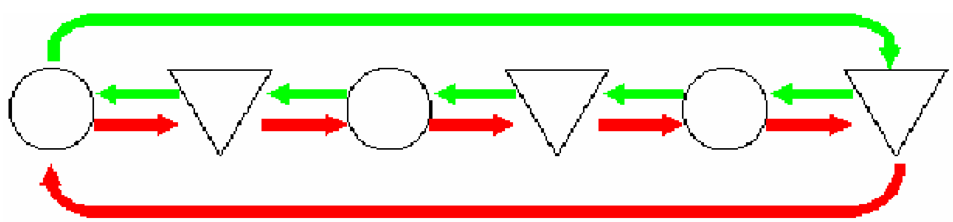

Fig 3.- C-VARWIP control. Flow of service shown in red, flow of release authorizations in green.

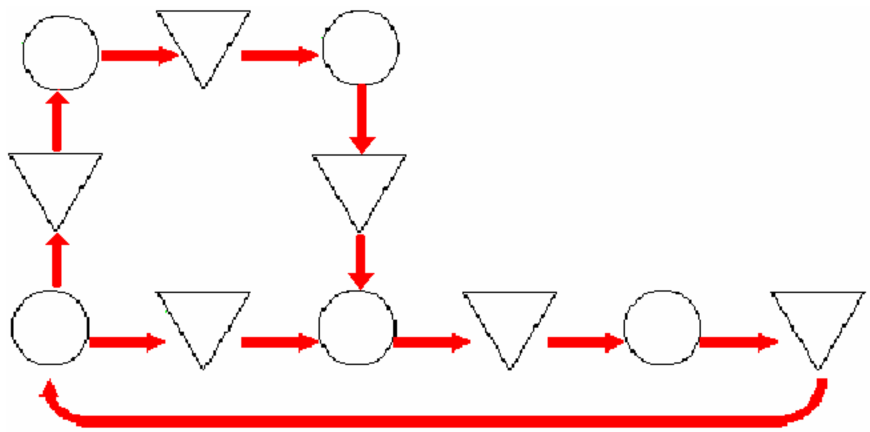

Fig 4.- C-VARWIP control. Flow of service shown in red, flow of locally synchronous release authorizations not shown.

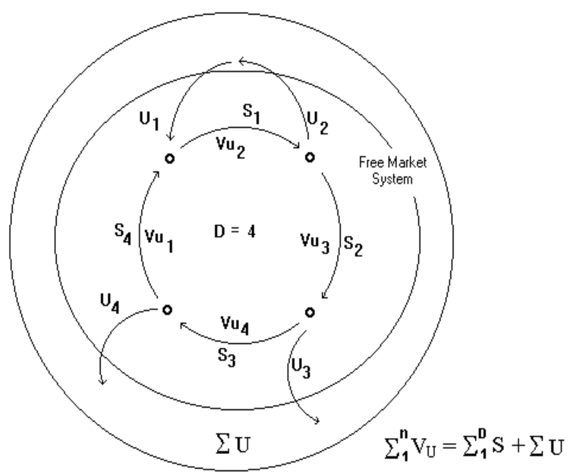

Fig 5.- Circular cash flow [5]