Chapter 10
Scheduling the Production Obtained by Means of Production Processes Organised in Variable Flow

I. C. Dima
University Valahia of Targoviste, Romania

ABSTRACT

The production processes are analysed, where multiple products are made in continuous or discontinuous flow, and their movement between two successive workplaces are performed in batches. It is a matter of homogenous groups of products and analogous groups of products that have the same order in terms of passing by the various workplaces, but it is not mandatory for these products to go by all workplaces. The processing times by operations of various products are not the same. Taking into account the synchronisation level, the flow production lines of the benchmarks can be in continuous flow or discontinuous flow, which requires or does not require an adjustment of the flow production line. It is necessary to know the order of assembling and delivering the finished products and the labour volume related to adjusting the machines to achieve a high level of loading the machines and equipment on the flow manufacturing line. The sizes, gauge, and volume of the parts that are processed on the flow production line must be known. It is necessary to elaborate the production schedule of the variable flow line that will take into account the nature of the products that are to be manufactured, the time needed to process each product at a workplace, the total product processing time achieved on that flow manufacturing line. For this, the level of loading every workplace and flow manufacturing line, the demand of performers stated in man/hour, time to occupy a job, and the manufacturing line, etc. will all be calculated. Should the production be achieved by production processes where a single operation is performed for similar products, but of different sizes or quality, the production schedule for this type of production shall correlate the production thusly achieved with the production capacity for a complete production cycle. Determining the frequency of releases of products into manufacturing is based on the criterion of production expenses totaled for all products that are made by processing in that operation.

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THEORETICAL CONSIDERATIONS

Those production processes applied for making multiple objects in continuous or discontinuous flow are included into this category. These processes exist in case of homogenous groups of parts (parts which go through the same workstations, in the same sequence, with the times of operations in a constant ratio) and analogical groups of parts (parts that have the same sequence of passing through the workstations, but which do not necessarily pass through all these places and they have different operation times).

The variable flow production is encountered in the double form of the rhythm of its own stated variant of the flow, and namely: in the form of the rhythm which the circulation of parts is subordinated to on the flow production line; in the form of a certain periodicity of launching the parts on the variable flow line.

In order to determine the dimension of the rhythm on each product (object), it is necessary to divide the calendar duration of the plan period \( T_d \), by partial periods \( T_{dA}, T_{dB}, T_{dN} \), proportional with the work volume needed to accomplish the task for the parts in the nomenclature (Courtois, Pillet, & Martin, 2000).

In this case, the line operating rhythm is determined as result of dividing the time calendar pool, to the size of plan load regarding the product appropriate standardised sizes:

\[
R_A = \frac{T_{dA}}{N_A} \text{ (min)}
\]

\[
R_N = \frac{T_{dN}}{N_N} \text{ (min)}
\]

According to the timing degree reached, a continuous flow or simple flow movement is achieved for the objects subject to processing on the variable flow production line.

In this case, the sequence and contents of further calculations for the parts remain similar to the aforementioned ones for the continuous flow or simple flow production.

First of all, the number of machines per operations is determined, the operating sequence of those respective workstations is adjusted, which do not have the same rhythm of operation, the hourly work schedule chart is compiled (for the simple flow production line), and the normal level of all types of stocks is determined.

The second form of variable flow production is related to a new adjustment of the flow production line in the case of passing from one object to another, meaning the dividing the launching of parts into processing into periods. Therewith, the problem of the number of—a certain type of—products (objects) is solved, products which shall be continuously launched to the flow production line.

This problem must be solved differently, if it is a matter about a variable flow, which directly delivers the finished production or mechanical processing of the parts, which supply the assembling process.

In the first case, the necessary number of regulations is determined by the number of product (objects) standardised sizes distributed on the line; the interval between these adjustments coincides with the calendar period assigned for manufacturing the appropriate standardised size products, based on the calculation presented.

In the second case, the following factors determine both alternating the various products (objects) on the variable flow line and the periodicity of launching, that is the batch sizes, and namely:

- **Sequence of Assembly and Delivery of Finished Products**: (If it is a matter of a variable flow in mechanical processing, under the conditions of assembling according to the “variable flow” principle);
- **Volume of Work Necessary for Adjustment and Existence on the Line of some**
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