Planning and leading of the technological processes by mechanical working with microsoft project

I Nae¹ and N Grigore¹
¹Mechanical Engineering Department, Petroleum–Gas University of Ploiesti, Ploiesti, Romania
E-mail: inae@upg-ploiesti.ro

Abstract. Nowadays, fabrication systems and methods are being modified; new processing technologies come up, flow sheets develop a minimum number of phases, the flexibility of the technologies grows up, new methods and instruments of monitoring and leading the processing operations also come up. The technological course (route, entry, scheme, guiding) referring to the series of the operation, putting and execution phases of a mark in order to obtain the final product from the blank is represented by a sequence of activities realized by a logic manner, on a well determined schedule, with a determined budget and resources. Also, a project can be defined as a series of specific activities, methodical structured which they aim to finish a specific objective, within a fixed schedule and budget. Within the homogeneity between the project and the technological course, this research is presenting the defining of the technological course of mechanical chip removing process using Microsoft Project. Under these circumstances, this research highlights the advantages of this method: the celerity using of other technological alternatives in order to pick the optimal process, the job scheduling being constrained by any kinds, the standardization of some processing technological operations.

1. General considerations
In the equipment and machine industry, the manufacturing of a product needs to follow a plan: the processing costs of the product, the time spent producing it and the quality of it. The quality of the final product depends on the quality of the montage and the components manufacturing processes [1].

From all the technological operations needed in order to manufacture the machines, the equipment, the rigs, the mechanical process is the most complex.

Within the technological process of mechanical operations of a product, is realized the technological course (route, entry, scheme, guiding) which consists in establishing the operations course, fitments/positions and phases (figure 1) used on the semi-fabricate in order to obtain the final product.

The technological course of a product is obtained by a series of stages (operations, fitments/positions, phases/processing sequences, movements, handlings, bypassing) scientifically coordinated [2], [3].

Within these conditions, by analysing the organization and the flow of a project (figure 2) and the technological course, a new method of organizing the technological flow is tried, using the application Microsoft Project [1].
2. Elaboration of the working model

The classical method used in order to determine the technological course consists in presenting a table in a succeeding logical manner of the operations, fitments/positions and phases/sequences applied on the semi-fabricate with the main purpose of obtaining a final product. For example, in table 1 it is presented the technological course (partially) of the body-cock mark. For the information’s presented in table 1, the upcoming mentions are done: operations are marked with I, II, III and so on, fitment/position is marked with A, B, C and so on, on every operation and phases/sequences are marked with 1, 2, 3 and so on, until the end of the technological course.

The proposed method uses as a support the application Microsoft Project, which is unique for a specific case of the technological course.

Using Microsoft Project, the advantages of the proposed method are presented below.

1. Establishing the technological course’s time span.

Using the app Microsoft Project, a series of information’s can be introduced, such as: the duration of the operation/fitment/technological phase, the start time and obviously, the calculus of the finish time (figure 3). In this way, the activities needed to be done can be time managed through their logical
scheme. The technological course’s duration is determined as the duration of the longest way that connects the beginning and the end of it. This can be identified using the specific view of the Microsoft View application (figure 4 – total duration of the technological course’s of the body-cock mark is 210.7 minutes). Another method to determine the durations of the operations and the fitments that compose the technological course is presenting the project’s plan hierarchically structured (on centralizing activities figure 3).

### Table 1. The technological course of the body-cock mark.

| Operation | Fitment | Phase’s naming | Fitment’s scheme | Machine-cutting tool |
|-----------|---------|----------------|------------------|---------------------|
| A 1       | Checking blank’s framing dimensions in the imposed scale | 1. Dimensional check | ![Image](image1.png) | Processing on the milling center TOYODA T01-Renishow |

| Operation | Fitment | Phase’s naming | Fitment’s scheme | Machine-cutting tool |
|-----------|---------|----------------|------------------|---------------------|
| A 2       | Milling the frontal surface 2 | 2. Roughing and finish milling | ![Image](image2.png) | Processing on the milling center TOYODA T02-Freza frontala |
| 3         | Milling the flange’s frontal surface 3 | | | |
| 4         | Milling the flange’s frontal surface 4 | | | |

2. Establishing the correlations between the technological course’s operations.

The relations between the operations come up in many more forms in Microsoft Project. The most used is Gantt Chart visualization (figure 5), where the relations between activities show up as lines the connect the activities.

3. Technological course’s ranking based on operations, fitments, phases.
In the particular case where the technological course is composed by a big series of activities (operations), it is necessary that these to be organized on phases or group activities well connected between. In Microsoft Project, phases are represented by centralizing activities (figure 4 – representation through blackened bars). A centralizing activity bears differently from other activities. Its duration cannot be edited, the start and finish date are directly calculated, because they derive from the composing activities.

![Figure 3](image1.png)

**Figure 3.** Technological course’s view of the body-cock mark using Microsoft Project.

![Figure 4](image2.png)

**Figure 4.** Establishing the technological course’s duration of the body-cock mark using Microsoft Project.
Centralizing activities are useful in order to obtain information’s about process’s phases (base time, costs). In this way, it is easier to control the technological course’s structure in case of process’s disorders or delays.

4. Establishing critical operations/activities and those that have time frame.

Critical way method follows the identification of critical activities and the critical way’s duration, because these can disturb the process (figure 6 – red marked bars). The failure to comply with the duration of the critical activities, leads to a delay to the whole process and so, to not complying with the deadline of the process.

![Figure 5. Correlations between activities view – Gantt graphic.](image)

![Figure 6. Critical way’s visualization.](image)
5. Defining the necessary resources of the technological course.
   Any operation is in underway by using some resources (human resources, financial resources, material resources, raw material), needed to obtain the final result of the process. Using the Microsoft Project application the resources needed for the technological course’s can be swiftly allocated and monitored through specific views (figure 7 – Resource Form view). Centralizing the resources allows to thoroughly monitor them split between operations, fitments, phases, etc.

6. Establishing the costs for the materials used.
   Using Microsoft Project, when introducing information about resources (figure 7) it is necessary to set the amount of time spent on processing the operation and it’s cost.

7. Establishing the total duration of the technological course, the amount of hours spent working and the calculus of the process’s cost can be easily identified using specific views (figure 4).

3. Conclusions
   By using Microsoft Project, the advantages of the proposed method are highlighted: rapidly using other technological processing methods (work scenarios) in order to pick the optimal method; typing some technological processing operations; creating a data base (technological courses) for elements with almost the same structure (geometrical or technological); planning the processing operations under vary circumstances (the most common are referred to base time, pause time etc.); obtaining some facilities referring to setting the time relating to the technical standard on operations and fitments; managing the activities budget and resources; costs control; establishing the work graphics; sorting and filtering the working data; vary views used to monitor the technological process (setting the critical path, highlighting the over-assigned resources etc.).

4. References
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