

ORIGINAL SOFTWARE PACKAGE FOR CALCULATING THE SELLING PRICE OF INDUSTRIAL PRODUCTS

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Abstract. The present paper highlights the great importance of the selling price of the industrial products, as an indicator for the economical efficiency of the engineering activities that led to the creation of an industrial product. The present paper is focused on expressing the selling price of industrial products by including the designing cost of the product in the category of direct costs. In this way it is developed an original software package that allows the rapid calculation of the selling price. The software package was created by using AutoCAD designing environment and VisualLISP and DCL programming languages, being very easy to use. The software product is based on a mathematical model that unlike other mathematical model met in the specialized literature, which include the designing cost within indirect costs, considers this type of cost a direct cost allows a company to identify possibilities for cost reduction. Other reason refers to the companies having as activity object product design and these companies have to express the cost of designing a single part, in order to calculate the price of this king of service. Thus, the present paper is focused on a possible way of cost reduction, as low cost is considered a universally attractive objective [1].

Keywords: selling price, industrial products, designing cost

1. Introduction

Product price is one of the more complex and critical decisions that managers must make. It is critical because price impacts not only the sale volume, but also the contribution that the product makes to the company's overall profit performance [2]. In many cases industrial companies have to deal with high production costs, a consequence of this problem being high selling prices and less sale volume. An industrial company cannot survive on the market place in these conditions for a long time, being forced to find ways for reducing costs. Specialized literature is not poor in approaches related to production costs and selling prices.

As it is known the selling price of industrial products is an important indicator that directly contributes to the success or failure of a product on the market place. The production cost, which is the main component of the selling price of an industrial product, has many components. Most of the papers and books from the specialized literature divide the production costs into two main categories: direct costs and indirect costs [3, 4, 5]. In the most of the cases the indirect costs are expressed in terms of the so called overhead or burden rate [4]. The burden rate has at its turn has many components that increase the total cost and

do not express the real or exact value of the cost. The cost of constructive design and technological design, which are very important for industrial companies manufacturing parts, are considered indirect costs and are included into the burden tare. One solution for finding possibilities for production cost reduction is to analyze the indirect costs and express them, if possible, directly on a single part. The present paper is focused on taking the constructive designing cost out from the burden rate and expressing it as a direct cost.

2. Mathematical Model for the Selling Price

The mathematical model presented within this paper for the selling price is also based on dividing the production costs in direct and indirect costs, but the novelty consists of expressing the constructive designing cost as a direct cost. The mathematical model is presented next.

$$P = Cc + \Pr, \qquad (1)$$

where: P – the product selling price [m.u./part]; Cc – the company cost [m.u./part] and Pr – the company profit [m.u./part].

$$Cc = Cs + Cgc , \qquad (2)$$

where: Cs - the shop floor cost [m.u./part]; Cgc – general company costs [m.u./part].

$$Cs = Cd + Ci, \qquad (3)$$

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where: $Cd - direct \ costs \ [m.u./part]; \ Ci - indirect \ costs \ [m.u./part].$

$$Cd = C_{mat} + C_l + C'_l + C_d + C_{st}$$
, (4)

where: C_{mat} – material costs [m.u./part]; C_l – direct labour costs [m.u./part]; $\dot{C_l}$ – other labour costs [m.u./part]; C_d – design cost [m.u./part]; C_{st} – cost of supply and transport [m.u./part].

$$C_{mat} = V_b \cdot \rho_b \cdot C_{kgb}, \qquad (5)$$

where: V_b – the volume of the billet [mm³]; ρ_b – the density of the billet material [g/cm³]; C_{kgb} – the cost of one kg of the billet material.

$$C_l = T_p \cdot S , \qquad (6)$$

where: T_p – the lead time [min/part]; the salary of the person that operates the machine that manufactures the part [m.u./min].

$$C_l' = k_l \cdot C_l \,, \tag{7}$$

where: $k_{\rm l}$ – coefficient that refers to the contribution of the employer to the health fund, protection fund, retirement pension fund and other contributions.

The design cost was developed in a previous paper of one of the authors [6] and is briefly presented next.

$$C_d = \left(C_{uc} + C_{usb} + C_{usdc} + C_{usds}\right) \cdot \tau_d , \qquad (8)$$

where: C_{uc} – the cost of use the computer [m.u./part]; C_{usb} – the cost of using the operating system, for example Windows [m.u./part]; C_{usdc} – the cost of using the designing environment, for example AutoCAD [m.u./part]; C_{usds} – the cost of using a specialized software for parameterized design [m.u./part]; τ_d – designing time [min/part].

$$C_{st} = k_{st} \cdot C_{mat}, \qquad (9)$$

where: k_{st} – a coefficient (4÷6%).

$$Ci = k_{br} \cdot C_l \,, \tag{10}$$

where: k_{br} – the coefficient of the shop floor burden rate.

$$Ccg = k_{br1} \cdot Cs \,, \tag{11}$$

where: k_{brl} – the coefficient of the company burden rate.

$$\Pr = k_{pr} \cdot Ccg , \qquad (12)$$

where: k_{pr} – the profit coefficient.

3. Software Package for the Selling Price

The software package destined for rapid calculation of the selling price and presented within this paper is based on the mathematical model previously presented. It is named by the authors *RoCAPM* because it is destined to managerial activities of an industrial company,

which now cannot be conceived without the use of computer. Thus, this software product refers to Computer Aided Production Management (CAPM). It was created using AutoCAD designing environment VisualLISP and and DCL programming languages. This software product is based on a user friendly interface which is made in accordance with the dialog box technique. The software package is working on the basis of more subprograms.

3.1. Algorithm of the Software Package

The software product presented in this paper works in two stages: the first stage refers to calculating the designing cost and the second stage refers to calculating the selling price of the product. Figure 1 highlights the algorithm of the software program.



Figure 1. Algorithm of RoCAPM Software

As it can be seen in figure 1, *RoCAPM* software is launched by the means of the new VisualLISP command *rocapm*, created by the authors. The first step is calculating the product designing cost. The user is then asked if he / she wants to calculate the product selling price. In case of an affirmative answer, the selling price is

rapidly calculated. All these calculus are possible due to the data introduced by the user in some dialog boxes. The software product works on the basis of a main program and of 7 VisualLISP subprograms and 4 DCL subprograms.

3.2. Application

The application of *RoCAPM* software presented within the present paper refers to an industrial product, which is a belt pulley, presented in figure 2.



Figure 2. Belt Pulley

The model of the belt pulley was created by the means of a special software product, named *RoCAD*, which also works on the principle of parameterized design.

The 3D model of the billet of the belt pulley is presented in figure 3 and the 2D model of the billet of the belt pulley is presented in figure 4.



Figure 3. 3D Model of the Billet

The working session is opened by launching the function *rocapm*, and on the computer screen the dialog box from figure 5 appears.





Figure 5. Dialog Box for Calculating the Design Cost

In the dialog box from figure 5 the user must enter some data necessary for calculating the cost of designing the part, which is the belt pulley from figure 2. These data are: the computer acquisition price; the monthly salary of the designer; the cost of electric energy; the acquisition price of the operating system, which is Windows; the acquisition price of the designing environment, which in the case of the belt pulley is AutoCAD; the acquisition price of a specialized designing environment, if necessary (in case of the belt pulley a parameterized software product for designing the part was used); the designing time; a coefficient of using the specialized designing environment per year. After validating these data by OK button, the result, which is the design cost of the belt pulley, is presented in the dialog box from figure 6.

AFISARE REZULTAT COST PROIECTARE	
Cost proiectare piesa [lei/buc]:	1.3065
OK Cancel	

Figure 6. Dialog Box for Presenting the Design Cost

For calculating the selling price of the belt pulley presented in figure 2, it is necessary to know the volume of the billet, which is presented in figures 3 and 4. AutoCAD designing environment is capable of offering different information about the solids designed. In this way the user can obtain information regarding the volume of the billet, as figure 7 presents.



Figure 7. Information Regarding the Billet

The dialog box for calculating the selling price of the belt pulley is presented in figure 8.

AFISARE REZULTAT COST PROIECTARE	×
Cost proiectare piesa [lei/buc]:	1.3065
Volum semifabricat (mm3):	676547
Pret unitar pntru semifabricat (lei/kg):	8.3
Densitate material semifabricat (kg/m3):	7000
Norma de timp (min/buc):	15
Salariu operator MUCN (lei/luna):	1300
Alte cheltuieli salariale (%):	30
Cheltuieli aprovizionare (%):	4
Regia sectiei (%):	130
Regia companiei (%):	10
Profitul companiei (%):	10
OK Cancel	

Figure 8. Dialog Box for Calculating the Selling Price

In the dialog box from figure 8 the user must enter the following data: the volume of the billet, the billet unitary price, the density of the billet material, the lead time for manufacturing the belt pulley, the monthly salary of the machine operator, other salary costs, supply cost, the shop floor burden rate, the company burden rate and the company profit. The design cost is automatically overtaken from the dialog box from figure 6. After validating these data by OK button, the results, which are the design cost, shop floor cost, company cost and selling price of the belt pulley appear in the dialog box from figure 9.



Figure 9. Dialog Box for Presenting the Final Results

4. Conclusions

The present paper presented a software package (*RoCAPM*) for rapid calculation of the selling price of the industrial products. This software is very efficient and user friendly, due to the interactive interface, which keeps a permanent dialog with the user. Unlike other methods for determining the product selling price, which include the designing cost of the product among indirect costs, *RoCAPM* considers this type of cost a direct cost. This approach allowed the reduction of the shop floor burden rate by 30%. Further researches of the authors of this paper are aiming at studying other components of the burden rate and further reducing it.

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References

- Slack, N., Chambers, S., Johnston, R., Brandon-Jones, A.: *Operation Management*. Prentice Hall, ISBN 978-0-273-70847-6, ISBN-10 0-273-70847-3, London, 2007
- 2. Fill, C., Fill, K.E.: Business to Business Marketing. Realtionships, Systems and Communications. Prentice Hall, ISBN 0 273 68279 2, Edinburgh, 2005
- 3. Popescu, M.: *Bases of Manufacturing Systems Engineering*. Transilvania University of Brasov, 2003
- Kalpakjian, S., Schmid, S.R.: Manufacturing Engineering and Technology. Prentice Hall, ISBN 0-13-148-965-8, USA, 2006
- 5. Zapciu, M., Cotet, E.C., Stefan, S.: *Managerial Techniques*. Bren Publishing House, ISBN 973-8143-21-7, Bucharest, 2001
- Gavrus, C.: Efficiency of an Original Software Package for Parameterized Design of Industrial Products. Proceedings of International Scientific Conference Material Science and Manufacturing Technology, Czech University of Life Sciences Prague, p. 52-57, ISBN 978-80-213-1792-5, June, 2008, Prague, Czech Republic