COMPUTER PRESENTATION OF THE CLOSED CIRCUITS IN MINERAL PROCESSING BY SOFTWARE COMUPUTER PACKETS

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ABSTRACT

In this paper will be shown computer application of softwares Minteh-1, Minteh-2 and Minteh-3 in Visual Basic, Visual Studio for presentation of two-products for some closed circuits od grinding-clasifying processes.

These methods make possibilities for appropriate, fasr and sure presentation of some complex circuits in the mineral processing technologies.

INTRODUCTION

Information about any mineral processing, for example efficiency or the values of parameters in the models of the processing units in the circuits, requires information about the flow rates and compositions of the streams entering and leaving the circuits. A lot of circuits flow measurements are made on feed and products streams and occasionally one or more of the internal streams.

Flow rates of the remaining streams are calculated by computer software packets or from other measured characteristics. Investigation of circuit efficiency using different techniques involves calculation of complete circuit material balances from incomplete raw plant data, calculation of model parameters from the completed set of plant data or circuit simulation on a digital computer followed by optimization studies.

Although of great use, the two-product formula does have limitations in plant accounting and control. The equations assume steady-state conditions, the fundamental assumption being that input is equal to output.

1.0. Introduction to Mass Balances on Complex Circuits

Some computer programmes in mineral processing technology which have represented two-product formula are known. Some of them are for sensitivity of the recovery equation, sensitivity of the mass equation, for maximizing the accuracy of computations.

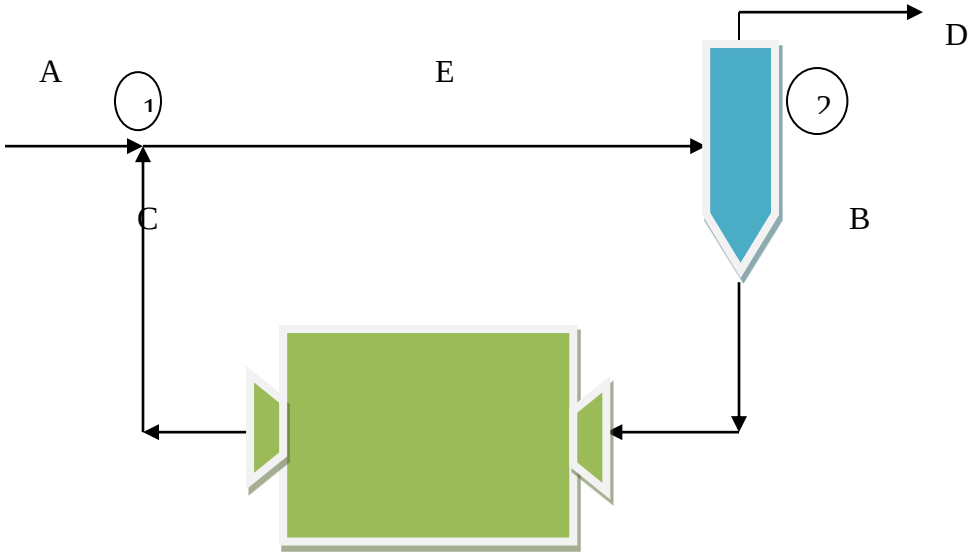
By the way, some computer programmes have used another more complex mathematical methods involving connection-matrix or reconcillation of excess data “curve- fiiting” etc.

1.1.The model of connection – matrix

The mathematical simulation may be defined as influences between *E* (efficiency of classifying), *C* (circulating load) and *a*, *b* are the percentage weights in any specific size fraction in the mill product. Using the connection-matrix or matrix algebra the little changes in the particle sizes are following:

$$E = \frac{c \cdot (a-b)}{a \cdot (a-b)} \cdot 100$$

$$C = \frac{c-a}{a-b} \cdot 100 \qquad (62)$$



$$f = \begin{pmatrix} f_1 \\ f_2 \\ \vdots \\ f_n \end{pmatrix} = (f_i)$$

$$C = \begin{pmatrix} c_{11} & 0 & 0 & \cdots\cdots & 0 \\ 0 & c_{22} & 0 & \cdots\cdots & \\ 0 & 0 & c_{33} & \cdots\cdots & \\ \cdot & & & & \cdot \\ \cdot & & & & \cdot \\ 0 & 0 & 0 & \cdots\cdots & c_{nn} \end{pmatrix} = (c_{ii})$$

$$M = \begin{pmatrix} m_{11} & 0 & 0 & 0 \cdots\cdots & 0 \\ m_{21} & m_{22} & 0 & 0 \cdots\cdots & 0 \\ m_{31} & m_{32} & m_{33} & 0 \cdots\cdots & 0 \\ \cdot & & & & \cdot \\ \cdot & & & & \cdot \\ m_{n1} & m_{n2} & m_{n3} & \cdots\cdots & m_{nn} \end{pmatrix} = (m_{ij})$$

1.2 Reconcillation of excess data "curve- fiiting"

Two basic methods have commonly been adopted, both of which use a least-squares approach, and they can be broadly classified as minimisation of the sum of squares of the residuals in the component closure equations (*Lagrange multipliers*) and minimization of the sum of squares of the component adjustment.

Table 1.

Tyler mesh	Circuit feed	Hydrocyclone			Circuit output
		feed	overflow	underflow	
+8	0.1			nil	
+10	0.4			0.3	
+14	1.0	nil		0.2	nil
+20	1.2	0.4		0.2	0.1
+28	1.6	0.3		0.3	0.1
+35	2.2	0.3		0.6	0.2
+48	2.9	0.9	nil	1.2	0.7
+65	4.7	1.7	0.1	2.1	1.5
+100	8.1	4.7	0.3	5.7	4.9
+150	9.3	8.9	0.8	9.9	9.3
+200	12.8	21.6	2.6	25.4	24.6
+325	14.1	30.9	13.8	33.5	32.0
-325	41.6	30.3	82.4	20.6	26.6

Table 2.

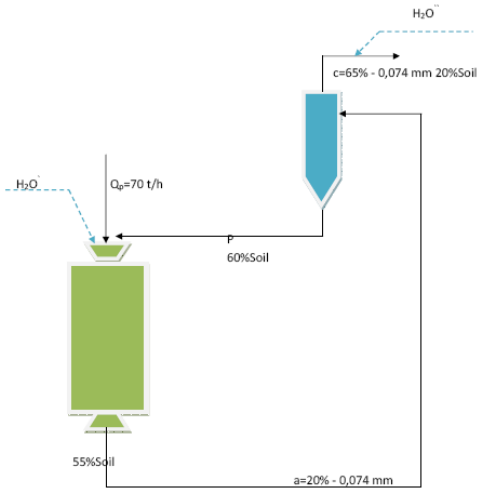
Tyler mesh	Stream residuals α =6.0872		Lagrange multipliers	
	Δ_1	Δ_2	λ_1	λ_2
+8	-0.10	0.0	0.0024	-0.0014
+10	-0.40	-1.53	-0.0114	0.0305
+14	-1.00	-1.02	0.0007	0.0103
+20	0.73	1.42	0.0023	-0.0235
+28	-0.28	0.30	-0.0108	-0.0109
+35	-1.39	-1.23	0.0160	0.0099
+48	-0.98	-0.63	0.0146	0.0013
+65	-1.98	-0.43	0.0408	-0.0168
+100	-4.42	-0.69	0.0947	0.0441
+150	-2.43	3.01	0.0985	-0.1042
+200	-6.46	-0.33	0.1477	-0.0804
+325	11.20	3.87	-0.2110	0.0617
-325	7.52	-2.75	-0.2148	0.1676

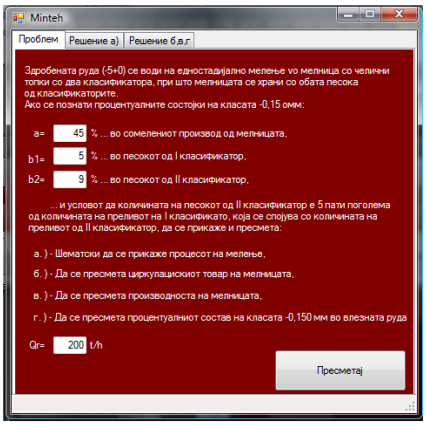
Table 3.

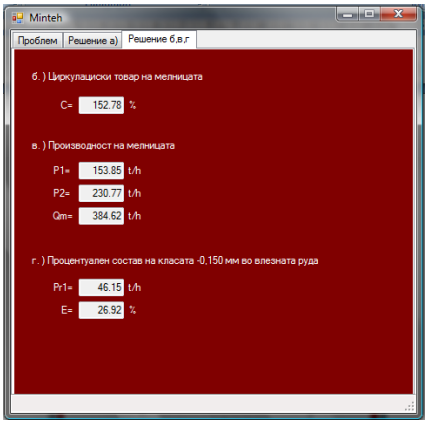
Tyler mesh	Circuit feed	Hydrocyclone			Circuit output
		feed	overflow	underflow	
+8	0.1	0.0	0.0	0.0	0.0
+10	0.4	0.1	0.0	0.2	0.1
+14	1.0	0.1	0.0	0.2	0.1
+20	1.2	0.3	0.0	0.3	0.1
+28	1.6	0.3	0.0	0.4	0.1
+35	2.2	0.5	0.0	0.6	0.1
+48	2.9	1.0	0.0	1.2	0.6
+65	4.7	1.9	0.1	2.2	1.3
+100	8.0	5.0	0.4	5.9	4.4
+150	9.2	8.9	0.9	10.4	8.8
+200	12.7	22.0	2.7	25.8	23.9
+325	14.3	30.0	13.7	33.2	33.1
-325	41.8	30.0	82.2	19.8	27.7

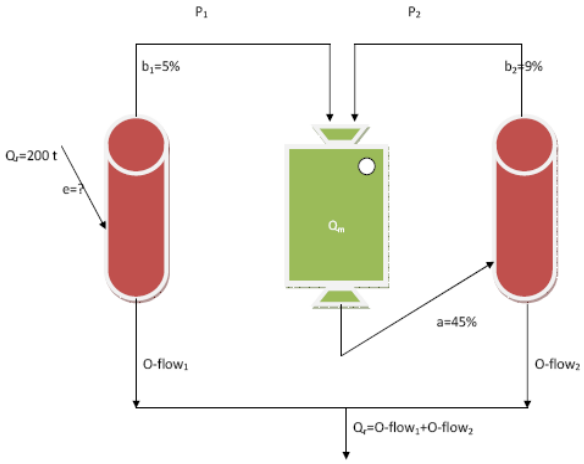
1.0 Application of the mineral processing softwares

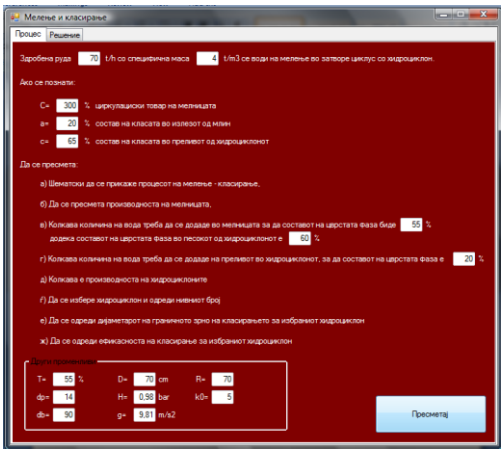
In this paper will be shown some examples of closed circuits of grinding – classifying applying computer programmes for their solving (MINTEH-2 and MINTEH-3 in Visual Studio 2008).

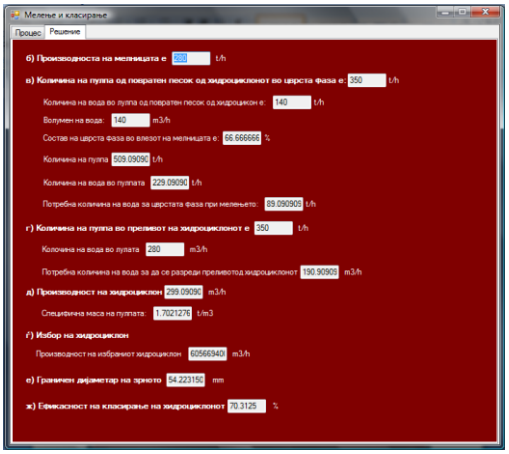












CONCLUSION

Application of computer softwares programmes is the strong way for presentation and forcasting of the possible optimal decision of the closed circuits of grinding-clasifying operations. This presentation is attept to represent a simple method of solving the problems of appropriate solution for different cases or models in mineral processing technology.

References

1. **Apling, A. C., *et al.*, Hydrocyclone models in an ore grinding context, in *Hydrocyclones* (ed. G. Priestley and H. S. Stephens), BHRA Fluid Engineering, Cranfield (1980);**
2. **Austin, L. G., "A Revieq Introduction to the Mathematical Description of Griuding as a Rate Process" Powder Technology, pp 1-27, 1972;**
3. **Grujic, M. et al. : Optimisation of Grinding Media Kinetics In the Ball Mill AIME – Meeting 1990, Salt Lake City, Utah, 1990;**
4. **Grujic, M., "Mathematical Modeling in Mineral Processing". SME Meeting Las Vegas, 1989;**
5. **Kawatra S. K., Eisele T. C., Weldum T., Lavsen D., Mariani R., Pletka J., Optimization of Comminution Circuit Through put and Product Size Distribution by Simulation and Control., MTU, Michgan, USA, 2005;**
6. **Kawatra S. K., Eisele T. C., Welgui H. J., Optimization of Comminution Circuit Through put and Product Size Distribution by Simulation and Control., MTU, Michgan, USA, 2004;**
7. **Kawatra, S. K., and Seitz, R. A., Calculating the particle size distribution in a hydrocyclone product for simulation purposes, *Minerals and Metallurgical Processing*, 2, 152 (Aug. 1985);**

8. **Lynch, A. J. Mineral Crushing and Grinding Circuits (Their Simulation, Optimisation, Design and Control) –1977;**
9. **Mular, A. L., (1972) Empirical modeling and aptinusation of mineral processes, Mineral Science and Engineering, 4, No 3. Pp 30-42;**
10. **Napier-Munn, T. J., Morrell, S., Morrison, R. D., and Kojovic, T., 1996. *Mineral comminution circuits: their operation and optimization.* JKMRC., pp. 413;**
11. **Renner, V. G., and Cohen, H. E., Measurement and interpretation of size distribution of particles within a hydrocyclone, *Trans. IMM.*, Sec. C, 87,139 (June 1978);**
12. **Rowland C. A., Grinding Calculations Related to the Applications of Large Rod and Ball Mills., Canadian Mining Journal., 93, 6 (1972), 48;**
13. **Wills, B. A. Mineral Processing Technology 4th edition –1988;**