The Affect of Input Factors on the Optimisation of Cutting Conditions and Production Costs in Turning with Cutting Inserts

Ludek Ruzicka*, Jan Madl
Faculty of Production Technology and Management, University J.E. Purkyne in Ustí nad Labem, Na Okraji 1001, 40001 Ustí nad Labem, Czech Republic. E-mail: ruzicka@fvtm.ujep.cz, madl@fvtm.ujep.cz

In this paper the effect of factors entering into the optimisation of cutting conditions and affecting production costs in turning is analysed. Optimisation of cutting conditions affects every manufacturing company in the field of machining, and represents an important area of the economy these enterprises. The aim of the research was to determine the size of the influence of input factors on the results of the calculation of the optimisation of cutting conditions using inserts in turning. Each constant is moving at a definite recommended range of values depending on various conditions. If we find out what the most important input factors most affecting the calculation of the optimisation of cutting conditions, we are able to focus primarily on the following factors. Influences of selected factors on costs are presented in graphs showing their interdependence. The influences of the input factors received from overall analysis were categorized by importance and created a list containing three groups significance of individual factors. According to the created groups a company can more easily focus on the parameters that most affecting the cost of turning, thereby improving the selection of specific technical, economic or time values in the company.

Keywords: optimisation, cutting conditions, production costs, inserts, turning

References

[1] ABELLAN, J. V.; ROMERO, F.; SILLER, H. R. et al. Adaptive Control Optimization of Cutting Parameters for High Quality Machining Operations Based on Neural Networks and Search Algorithms. *Advances in Robotics, Automation and Control*, Jesus Aramburo and Antonio Ramirez Trevino (Ed.), InTech, 2008. 472 s. ISBN 978-953-7619-16-9.

[2] ČUBAN, J.; KOLAVČÍK, J. Comparison of coated carbide cutting toll inserts used in machining of cylinder liners made of grey cast iron. *Manufacturing technology*, 2009, vol. 9, p. 23-30. ISSN 1213248-9.

[3] DEGARMO, E. P.; BLACK, J. T.; KOHSER, R. A.: *Materials and Processes in Manufacturing*. 8th ed. New York: Prentice-Hall, 1997. 1257 s. ISBN 0-02-328621-0.

[4] JERARD, B. R.; FUSSEL, K. B.; ERCAN, T. M. On-line Optimization of Cutting Conditions for NC Machining. *Manufacturing & Industrial Innovation Research Conference*, Jan 7-10, 2001. Tampa, Florida.

[5] JERSÁK, J. et al. Surface integrity of hardened bearing steel after milling. *Manufacturing technology*, 2010, vol. X, p. 80-87. ISSN 1213248-9.

[6] KOUKOL, V.; MÁDL.: Kalkulace nákladových položek a jejich členění pro optimalizaci řezných podmínek. *Strojírenská technologie*, 2006. roč. XI, č. 1, s. 18-20. ISSN 1211-4162.

[7] KOUKOL, V.; MÁDL, J. Metoda target costing a optimalizace obráběcího procesu. *Strojírenská technologie*, 2007. roč. XII, č. 3, s. 25-29. ISSN 1211-4162.

[8] KOVALČÍN, J. Comparison of cutting tool insert´s made of oxide cutting ceramic machining of grey cast iron. *Manufacturing technology*, 2009, vol. 9, p. 57-67. ISSN 1213248-9.

[9] KUNDRÁK, J. Alternative machining procedures of hardened steels. *Manufacturing technology*, 2011, vol. XI, p. 32-39. ISSN 1213248-9.

[10] MÁDL, J.: *Optimalizace obráběcího procesu*. Praha: ČVUT, 1998. 168 s. ISBN 80-01-01864-6.

[11] MENG, Q.; ARSECULARATNE, J. A.; MATHEW, P. Calculation of optimum cutting conditions for turning operations using a machining theory. *International Journal of Machine Tools & Manufacture*, Sydney, Australia, 2000. Vol. 40, No. 12., s. 1709 – 1733. ISSN 0890-6955.

[12] RÁZEK, V; MÁDL, J.; MÁCHA, P. Faktory ovlivňující náklady obrábění – I. část. *Strojírenská technologie*, 2005. roč. X, č. 4, s. 20-24. ISSN 1211-4162.

[13] VENKATESWARA RAO, P.; VENU GOPAL, A. Selection of optimum conditions for maximum material removal rate with surface finish and damage as constraints in SiC grinding. *International Journal of Machine Tools and Manufacture*, Indian Institute of Technology Delhi, New Delhi, India. 2003. Vol. 43, Issue 13, s. 1327-1336. ISSN 0890-6955.

[14] WANG, J.; KURIYAGAWA, T. et. al. Optimization of Cutting Conditions for Single Pass Turning Operations Using a Deterministic Approach. *International Journal of Machine Tools and Manufacture*, Australia. 2002. Vol. 42, s. 1023-1033. ISSN: 0890-6955.

* Ph.D. student Ludek Ruzicka was supported (grant) by company SEVEROCESKE DOLY CHOMUTOV, a. s. on research stay in Poland.

 Paper number: M201396

Manuscript of the paper received in 2013-09-04. The reviewer of this paper: *Gyula Varga.*