Mohannad N. Houshi , ***"Studying the effect of contact area between cutter and workpiece on surface roughness and cutter runout during milling operation"*** , University of technology , Department of production engineering and metallurgy ,Asst.Prof.Dr. Saad Kariem Shather, (2009), 110.P

Abstract

This thesis focuses on studying effect of contact area between cutter and workpiece on the surface roughness and cutter runout during milling operation , since the contact area in milling operations depends on the cutter geometry, especially (cutter diameter and width).So, six different types of milling cutters in their contact area with workpiece are taken. Three of them are flat end mills in different diameters as following (Ø16mm , Ø12mm , Ø6mm) , whereas other cutter geometry parameters are constant , these are used in vertical milling .Other three are helical plain cutters in different widths as following (80mm ,63mm ,40mm) , used in horizontal milling , when other cutter geometry parameters are constant. As for workpiece material, it was from (structural steel (1.0402)) according to (DIN:C22) specifications, and this material is suitable to verify of research requirements from cut operations and cost.

After completing the experimental tests with different cutting conditions (spindle speed, feed rate, and depth of cut) for each cutter, the results show that milling cutter, which has larger diameter (Ø16mm), gives less surface roughness and cutter runout compared with other two types in vertical milling case. Whereas in horizontal milling the results show that milling cutter, which has larger width (80mm), gives large surface roughness and cutter runout compared with other two types.

In this thesis the influence of the spindle speed, feed rate, and depth of cut on the surface roughness for each six cutters are studied .The results show that the surface roughness decreases with the increase of spindle speed under constant feed rate and depth of cut. While surface roughness increases with increase of feed rate for constant spindle speed and depth of cut .Both the results of fixing spindle speed and feed rate with changing depth of cut show that surface roughness increases with the increase of depth of cut. With respect to the influence of the spindle speed, feed rate, and depth of cut on the cutter runout for each six cutters, the results show

that the cutter runout decreases with the increase of spindle speed under constant feed rate and depth of cut. Whereas cutter runout increases with the increase of feed rate for constant spindle speed and depth of cut.

As for results of fixing spindle speed and feed rate with changing depth of cut, they show that cutter runout increases with the increase of depth of cut. It is concluded that milling cutters geometry has a large effect on determining the contact area between cutter and workpiece .In addition, cutter runout has a large effect on the surface roughness because it causes an increase in surface roughness of workpiece.

In this study, multiple linear regression model is used within (SPSS) software to predict the experimental data for each surface roughness and cutter runout for different six cutters and results show from comparing between predicted and measured values that (SPSS) software gives high prediction accuracy. For the prediction of surface roughness, the prediction accuracy has been (90.7% , 96% , 98.7% , 93.8% , 98.6% and 98.6%) for cutters (16mm dia. ,12mm dia.,6mm dia., 80mm width , 63mm width and 40mm width) respectively ,whereas in cutter runout prediction case , the prediction accuracy has been (87.02% , 97.04% , 99.3% , 97.06% , 97% and 96.9%) for cutters (16mm dia. ,12mm dia.,6mm dia., 80mm width , 63mm width and 40mm width) respectively .

Keyword: - surface roughness, cutter runout, contact area.