ABSTRACT

In the milling process, the resulting product must have high quality in a short time. Quality is related to surface roughness while productivity is related to material removal rate. Both interdependence and correlation are complex and difficult to understand due to many influencing factors such as machining parameters. Mostly the cutting parameters are selected based on experience or referring to the handbook so it does not guarantee that the optimal parameters are selected. If the one chosen is wrong or not optimal, it will cause wastage of material, labor, energy and electricity, cutting fluid, and cutting tools that lead to cost losses from the production process. This research focuses on optimizing multi-response to minimize surface roughness as well as maximize material removal rate on aluminum alloy material 6061 T6 in Hauw Gan ZX 7550Z milling machine. This material was chosen because of its advantages such as relatively high tensile strength, good formability, and corrosion resistance. Experiments were carried out using three input parameters, namely spindle speed, feed rate, and depth of cut based on the L_9 orthogonal array which was designed using the Taguchi method. Taguchi method is collaborated with gray relational analysis to achieve two desired responses simultaneously. ANOVA test is used to identify which input parameters have the highest contribution. ANOVA test results show that the depth of cut is the machining parameter with the greatest contribution, which is 36,335% on the performance characteristics of the milling process. Finally, verification is carried out to compare the results between the initial parameter settings of the *grey relational grade* with the optimal machining parameters obtained. As a result, the optimum surface roughness (Ra = 0.395 m) and material removal rate (MRR = 105 mm^3/min) were obtained from the parameters combination of spindle speed 1400 rpm, feed rate 15 mm/min, and depth of cut 0.7 mm.

Keywords — ***Surface roughness, Material Removal Rate, Taguchi, Grey Relational Analysis***