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Surface Roughness Prediction Using Numerical Scheme and Adaptive Control

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Abstract : This paper proposes a numerical modelling scheme for surface roughness prediction. The approach is premised on the use of 3D difference analysis method enhanced with the use of feedback control loop where a set of adaptive weights are generated. The surface roughness values utilized in this paper were adapted from [1]. Their experiments were carried out using S55C high carbon steel. A comparison was further carried out between the proposed technique and those utilized in [1]. The experimental design has three cutting parameters namely: depth of cut, feed rate and cutting speed with twenty-seven experimental sample-space. The simulation trials conducted using Matlab software is of two sub-classes namely: prediction of the surface roughness readings for the non-boundary cutting combinations (NBCC) with the aid of the known surface roughness readings of the boundary cutting combinations (BCC). The following simulation involved the use of the predicted outputs from the NBCC to recover the surface roughness readings for the boundary cutting combinations (BCC). The simulation trial for the NBCC attained a state of total stability in the 7th iteration i.e. a point where the actual and desired roughness readings are equal such that error is minimized to zero by using a set of dynamic weights generated in every following simulation trial. A comparative study among the three methods showed that the proposed difference analysis technique with adaptive weight from feedback control, produced a much accurate output as against the abductive and regression analysis techniques presented in this.

Keywords : Difference Analysis, Surface Roughness; Mesh- Analysis, Feedback control, Adaptive weight, Boundary Element
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