

# Material Defect Detection and Assessment of Surface Roughness Using Image Processing and Machine Vision System

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**Abstract---** In this paper, machine vision technology was adopted to assess the surface roughness of the parts machined by the milling process. Machine vision allows for the assessment of surface roughness without touching or scratching the surface. About 32 samples were machined by the milling process under various cutting parameters and images of the machined surfaces were captured using CCD camera. Consequently, widely used conventional average surface roughness 'Ra' is measured using surfcometer (A stylus based instrument). The images are processed using various image processing techniques in MATLAB, to ease the extraction of surface roughness features. The average of the variances of randomly selected columns from the pixel matrix of the processed gray scale indexed image were calculated and taken as surface roughness feature 'F'. Similarly, one more feature 'E' called entropy was derived from the processed image. Both the features were found to be fairly in good correlation with the conventionally measured surface roughness Ra. A simple multiple regression model was also generated, which better represented the relationship between the derived features and the surface roughness Ra.

**Keywords---** Machine Vision System, Surface Measurement, Surface Roughness.

## I. Introduction

Machine vision has developed to become a mainstream automation tool enabling computers to replace human vision in high speed and precision manufacturing techniques. The research work is to assess surface roughness of machined parts produced by milling process by image processing. Machine vision allows for the assessment of surface roughness without touching or scratching the surface.

The quantitative measures of surface roughness are extracted from the images processed by image processing technique.

The roughness features derived from the processed image was used to create a multiple regression model. It provides the advantages of a measurement process for 100% inspection.

This investigation has presented a new technique for the on-line control of the surface roughness in the finish turning operation.

By means of tool image detection and processing, the ideal roughness profile that the tool should produce on the work piece is evaluated. A model to estimate the value of the effective roughness of the work from one related to the ideal profile was proposed.

They have concluded that their model is not significantly influenced by the feed employed [1]. And the surface quality of the components produced in a grinding process mainly depends on the grinding wheel topography. Hence to maintain the quality of the component, the condition of the grinding wheel should be monitored and the periodical dressing has to be done to retain the shape and the sharpness of the cutting edges [2].

## II. Machine Vision

Machine vision is the capturing of an image (a snapshot in time), the conversion of the image to digital information, and the application of processing algorithms to extract useful information about the image for the purpose of pattern recognition, part inspection, or part positioning and orientation. Figure 1 represents a Machine vision system [3].