Advances in Materials and Manufacturing

Part 2

Edited by
K. Palanikumar

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Advances in Materials and Manufacturing

PART 2

Selected, peer reviewed papers from the
International Conference on
Advances in Materials and Manufacturing Engineering
(ICAMME-2014),
December 19-20, 2014, Chennai, India

Edited by

K. Palanikumar

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Preface

The Proceedings of the International Conference on Advances in Materials and Manufacturing Engineering (ICAMME2014) disseminates the knowledge between the Scientists, Engineers and Technocrats in the field of Materials and Manufacturing. After the cautious review by Technical Committee consisting of experts in the field, 193 papers are selected for final Publication in this volume. The conference was successfully held in Sri Sairam Group of Institutions, Chennai, India on 19th& 20th December 2014. Around 400 researchers participated in the conference. We have received more than 300 articles, among that 193 were selected by our expert reviewers. These selected articles were presented in our conference. In this connection we have categorized in to twenty chapters.

Potential topics are addressed in this conference about various areas in Manufacturing and Materials Engineering providing a forum to exchange ideas and to discuss on emerging issues of Mechanical Engineering. The highlight of the conference includes Paper Presentation, invited Guest lectures, Panel discussion with recommendation which will be forwarded to the funding and government agencies for implementation.

We would like to thank the people who have contributed to the success of the conference, especially our Chairman MJF. Ln. Leo Muthu and our CEO Mr. Sai Prakash Leo Muthu of Sri Sairam group of Institutions. Our sincere thanks goes to the participants of the conference. We would like to express our gratitude to all the members of the Organizing Committee for the efforts they have made before and during the conference.

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A Review on Applications of Image Processing in Inspection of Cutting Tool Surfaces

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Keywords: Tool surface inspection, Image processing, Tool wear, non contact inspection system

Abstract:

The increase in demand for industrial automation in the manufacturing industry has exposed the significance of machine vision in quality inspection and process monitoring. Contrast to stylus instruments, the computer vision systems have the advantages of being non-contact. In the present study a novel technique has been reviewed to explore various applications of Image processing in inspection of cutting tool surfaces. Measurement and inspection of Surface roughness, Tool wear, Tool profile, Thickness of coating done on tool and Surface defects are all reviewed in this paper which will help in developing a specialized inspection system particularly for inspection of machining tools alone in reduced production cost and minimised time.

Introduction:

Obtaining an acceptable surface finish within tolerance is the major function of machining. But one major problem posed by the requirement to ensure high machine utilization is the ability to correctly classify the wear state of the cutting tool. To ensure proper representation, cutting tools must be periodically checked and the wear measured for possible or premature failures. With the advent of automation, surface characterization needs to be totally computerized so that the task of inspection of surfaces is greatly simplified. Unlike the stylus instruments, the computer vision systems have the advantages of being non-contact and are capable of measuring an area of the surface rather than a single line which makes it suitable for 3D evaluation and thereby reduces time of inspection [2]. The surface texture of images has been identified, analysed and quantified using vision system. Surface texture is an important characteristic for the analysis of many types of images [5]. Image texture can be qualitatively evaluated as having one or more of the properties of fineness, coarseness, smoothness, granulation and irregular. A solution to the texture analysis problem will greatly advance the image processing fields and it will also bring much benefit to many applications in the areas of industrial automation. The demand for all kinds of high precision cutting tools relatively increases owing to rapid developments in the modern cutting technology and materials. Surfaces with different textures were obtained by controlling machining parameters [1].

The Image processing technique used for tool surface monitoring consists of a CCD camera which grabs images and then the images were pre-processed to eliminate effects due to illumination and noise. This is a technique that utilizes both the spacing between grey level peaks and the number of grey level peaks per unit length of a scanned line in the grey level image to estimate the surface parameters. Currently there exist many optical techniques for surface measurement like surface profilometers, fibre optic sensor, SEM, infrared scatterometer to estimate the nature of the surfaces. Along with those, this new technique could be a promising one to measure the surface parameters with higher accuracy [2].

Digital Image Processing system

The Digital Image Processing system for tool surface monitoring consists of a CCD camera, a macro lens, a light source, a PC and suitable software [11]. The basic operations performed in a

digital image processing systems as shown in fig.1 and 2 include (1) acquisition, (2) storage, (3) processing, (4) communication and (5) display.

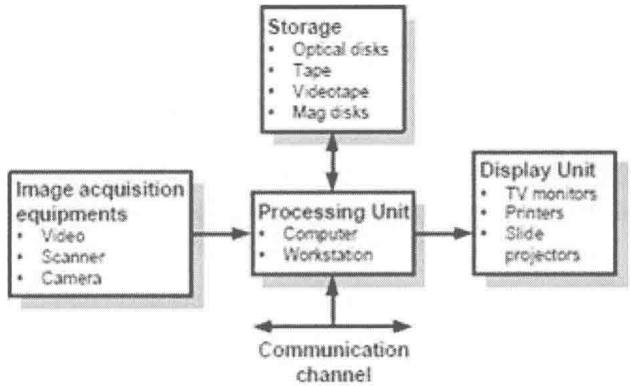

Fig.1 Basic fundamental elements of an image processing system [10, 11]

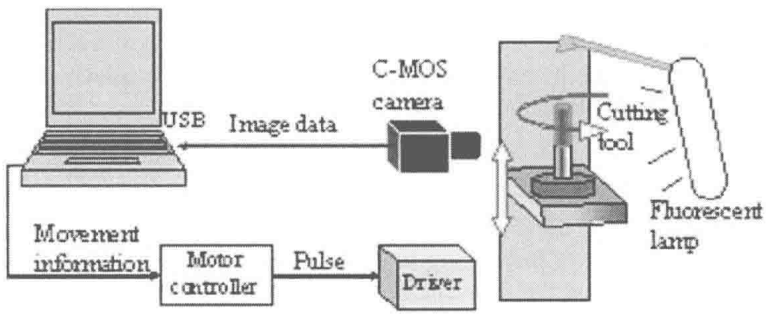

Fig.2 Scheme of the defect inspection system [5]

Surface Roughness:

The measurement of engineering surface roughness is very much important particularly in the case of mechanical surfaces. Several investigations have been carried out by earlier researchers to inspect surface roughness of a work piece based on computer vision technology. Work pieces are made using different manufacturing processes such as grinding, milling and shaping with varying surface roughness. A quantitative parameter called the optical surface roughness parameter Ga is used to estimate the surface roughness of the machined surface and to test the quantification parameters evaluated using this new system [1]. Measurement of surface roughness parameter 'Ga' optically from an image and conventional average surface roughness 'Ra' obtained from the stylus instrument measured on ground, milled and shaped surfaces are compared. It was observed that the optical surface roughness parameter Ga was in good correlation with the stylus Ra values [1]. The Machine vision approach can be used to evaluate the surface roughness of machined surfaces and there is a good linear relationship between Ra and Ga with a high level of accuracy. Hence the image processing technique can be substituted for conventional measuring system to reduce inspection time and manual errors.

Tool Wear measurement:

Tool wear measurement is of great concern in machining industries for maintaining the surface qualities, précised dimensional accuracy and cost of production of the machined components. It is also necessary to record the cutting history for a tool utilization in order to determine whether or not a tool can be safely and continuously used for a more reliable and accurate control of the machined