Image Processing of Metal Parts using Quality Inspection Method in Comparison with MATLAB

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Abstract—this paper proposes a novel image processing approach for rapid quality inspection in metal parts of machinery products. The quality inspection approaches have evolved from the traditional visual inspection to sophisticated techniques like automated pattern recognition. The paper concentrates a novel image processing algorithm for rapid and cost-effective quality detection of metal surfaces. The process deals with analysis of the metal product images and extracting the crack location using appropriate thresholding. Hence, these values are determined from the histogram of the mental image from which the deviations between weld surface and normal surface being found from ranging intensity values. The images of the metal products are acquired with the help of calibrated camera sensors in an ideal lab set up in order to avoid the illumination effects which will interfere with the crack surface. The mental image enhances precursor for crack-feature detection. The cracks in the metal products are detected analyzed using the MATLAB interface where the Image Processing Toolbox provides a comprehensive set of reference-standard algorithms and functions for analysis, Visualization and algorithm development. The dimensional analysis and qualitative aspects of the crack are recorded to determine the quality status of the metal product. Thus, this approach is implemented for four mild steel specimens and a higher accuracy in the detection process is observed. Further, the compatibility of the algorithm with metal surface with varied sizes and colors are analyzed.

Key words: Mat lab, Analysis, Inspection, Diagnosis

I. INTRODUCTION

The present world is the speed of light to reach the innovative ideas and being dependent on the care of expenditure. The objective of this paper is about the inspection machined components with non-expendable methods. The various testing methods include destructive and non-destructive are expendable. Our technique uses the image source for detection of defects in the materials in industries at faster rate using the MATLAB.

II. HYPOTHESIS

The experimental setup can be made in a small prototype by placing the friction stirwelded butt joint piece in a cuboids. Where a sliding mechanism undergoes at the top rectangular surface of the cuboids attached with a web camera of 8 mega pixels to capture weld images which is stored in the memory retrieved to the computer where we use the tool called mat lab to detect the defects in the welded portion. MATLAB (matrix laboratory) is a numerical computing environment and fourth-generation programming language. Here the various histograms, bar chart and curves are plotted to the images describing that the defects is present or not. Similarly we can use the same technique in the industry to find cracks, cored holes, and all other defects in metal works easily. It is a time saving, and non expandable process.

III. WORKING METHODOLOGY

The basic step in this process includes usage of matlab to find defects in the friction welded piece. For which the welded metal piece is diagnosed in the matlab then algorithm is made for it to draw different charts explaining the defects. The algorithm is given below figure

Fig 1: Friction welded material to be processed.

A. Setting up of Web Camera:

The rotating 360 degree web camera with 8 pixels is made to revolve against the surface of weld or metal works. Computer systems:

The computing systems must consist of matlab latest versions with all facilities to edit the pictures and draw graphs on the cracked surface.

B. Matlab Image Processing:

Image Processing Toolbox provides a comprehensive set of reference-standard steps in development of algorithms which enables to perform image development with following the study of image deblurring that finally gives feature detection as well as noise reduction. Many toolboxes functioning in multithreads take advantage of multiprocessor computers. Image Processing Toolbox supports a diverse set of image types in case of high dynamic range in another case gigapixel resolution & embedded ICC profile. Visualization functions enhance to explore an image, examination of pixels, contrasting, create histograms, and manipulate regions of interest (ROIs). With toolbox algorithm enables to restore degraded images which leads to detect and measure features and also to analyze shapes and textures by adjusting the color balance.

C. Drawing of Histogram using Algorithms in Matlab:

The histogram is drawn to show difference between the weld surface and normal surface. Thus the histogram, maps a chart gives detail of calculation about crack or defects.
The above images describe the image processing underwent in the taken image.

D. Algorithm to convert RBG image to gray scale image:

```matlab
>> Im1 = imread('img.png');
Im1 = rgb2gray(Im1);
I = imread('img.png');
J = rgb2gray(I);
figure, imshow(I), figure, imshow(J);
hist(Im1, numel(Im1));
Im2 = rgb2gray(Im2);
I = imread('img.png');
J = rgb2gray(I);
figure, imshow(I), figure, imshow(J);
hist(Im2, numel(Im2));
Im3 = rgb2gray(Im3);
I = imread('img.png');
J = rgb2gray(I);
figure, imshow(I), figure, imshow(J);
hist(Im3, numel(Im3));
Im4 = rgb2gray(Im4);
I = imread('img.png');
J = rgb2gray(I);
figure, imshow(I), figure, imshow(J);
hist(Im4, numel(Im4));

% Program representing the drawing of histograms in Matlab.

Fig 2 Matlab Processed View.

Fig 3 Matlab view of welded portion

Fig 4: Defects shown in bar diagram

Fig 6 Histogram for given image

Fig 7 RBG image of given image

Fig 8 Gray Scale converted image
E. Algorithm to threshold the image:

```matlab
>> I = imread('11.png');
Im1 = imread('11.png');
Im1 = rgb2gray(Im1);
I = imread('11.png');
J = rgb2gray(I);
figure, imshow(I), figure, imshow(J);
Im1 = imhist(Im1)/numel(Im1);
BW=roicolor(J,56,77);
figure, imshow(BW)
```

1) Determination of Size of Crack
- Length of the crack = Difference between starting point and ending point pixel of crack in the image
- Size of the crack = (length of the crack * width of the crack)

![Fig. 9: Crack detected in the given image](image)

IV. CONCLUSION

Thus the above paper would clearly explain various methodologies to illustrate the defects in a metal piece and it is one of the non-expendable methods. It can be implemented in various industries by setting up a web camera rotary motion about the welded or all metal surface and connected computer where mat lab detects the defects. Hence the solution for expendable testing like NDT, ultrasonic inspection may be overcome by this method. Thus the various defects in the welded portion are detected using the tool. This method is not yet used or practiced. It is non expandable one and can be used to save time and money. If it is to be in experimented the faster rate of growth in quality high production and defect free component releases will increase leading to greater productivity sales. Other testing processes like NDT (Non Destructive Testing), ultra sonic inspection are more time consuming and expendable one. If the further development is made in this the technique we achieve vast growth in the field of detection of cracks and defects in metal pieces or the components used in machineries.

REFERENCE
