# Improving the Forging Inspection Efficiency of Work Piece in Casting Process

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***Abstract*—In the forging industry precision over the dimension of work piece manufactured by the forging process is checked at the completion of the whole forging process including the blasting process and that too manually, which still can be of somewhat less accuracy. Moreover, the labors do all the process manually so the process is also slow and less efficient. To overcome all such problems we have came across with two simple solutions, increasing accuracy by image processing with image sensing and increasing efficiency.**

***Index Terms*—forging, accuracy, efficiency.**

## I. Introduction

The prime objective of this paper is to improve forging inspection efficiency through image processing.

Forging is a manufacturing process involving the shaping of metal using localized compressive forces. Forged parts can range in weight from less than a kilogram to 580 metric tons. Forged parts usually require additional processing to achieve a finished part.

The most common type of forging equipment is the hammer and anvil. The principle behind the machine is very simple—raises the hammer and then drops it or propels it into the workpiece, which rests on the anvil. The main variations between drop hammers are in the way the hammer is powered; the most common being air and steam hammers.

In the example of impression die forging, two dies are brought together and the workpiece undergoes plastic deformation and then, a small amount of material begins to flow.

Outside the die impression forming flash that is gradually thinned. The flash cools rapidly and presents increased resistance to deformation and helps build up pressure inside the bulk of the workpiece that aids material flow into unfilled impressions. By its very nature, forging improves grain structure in the finished part. Metal billets go through plastic deformation as they're forged and as a result the metal grains align in the direction of flow. The tolerances range from 1 mm in small parts up to 5 mm in large parts, but according to requirements,because reducing tolerances increases costs. Forging is often combined with machining for improved accuracy. Cold coining or sizing in house can also close tolerances and reduce the need to machine some parts.

Now as we have come across the various problems in the industry of measuring the accuracy and they are time consuming. To overcome such problems we are introducing the new technology of image processing for the measurement of the work piece.

## II. 3D MAPPING TECHNIQUE

The triangulation 3D laser scanners are also active scanner that use laser light to stable the environment. With respect to time-of-flight 3D laser scanner the triangulation laser shines a laser on the subject and exploits a camera to look for the location of the laser dot. Based on how far away the laser strikes a surface, the laser dot appears at different places in the camera's field of view. This technique is called triangulation because the laser dot, the camera and the laser emitter form a triangle. The length of one side of the triangle, the distance between the camera and the laser emitter is known. The angle of the laser emitter corner is also known. The angle of the camera corner can be defined by looking at the location of the laser dot in the camera's field of view. These three information fully determine the shape and size of the triangle and gives the location of the laser dot corner of the triangle. In most cases a laser stripe, instead of a single laser dot, is swept across the object to speed up the acquisition process. The National Research Council of Canada was among the first institutes to develop the triangulation based laser scanning technology in 1978.

The method for recording the images is relatively simple: as the turntable rotates the object, the webcam records a series of images. The Will Strobernext step, determining a series of points from each image, requires a bit more thought. For each image, the y-coordinate is known, as this is the given starting point for each point to be determined. The center of rotation, or COR, is also known, as it is a part of the initial setup. The x-position of the laser line is determined by finding the column with the most intense measure of red light for each row. The distance between the COR and the laser line gives the x-coordinate for each y coordinate, as shown in Fig.. This is an effective way to do it, because even if the laser angle is slightly inaccurate, it will cause an anamorphic transformation of the x-coordinates, which can be easily adjusted for later on. If the angle is slightly inaccurate, it will be offset by the same amount in each recorded image, which can be easily adjusted by the aforementioned anamorphic transformation of the x-coordinates.

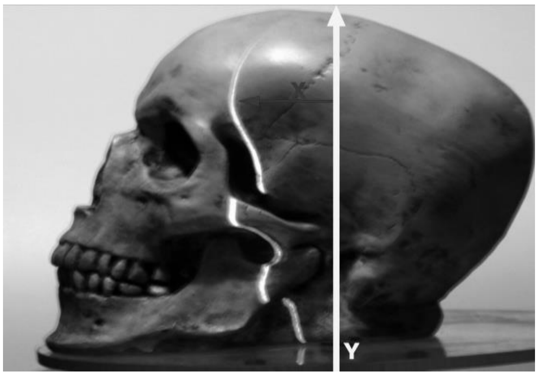
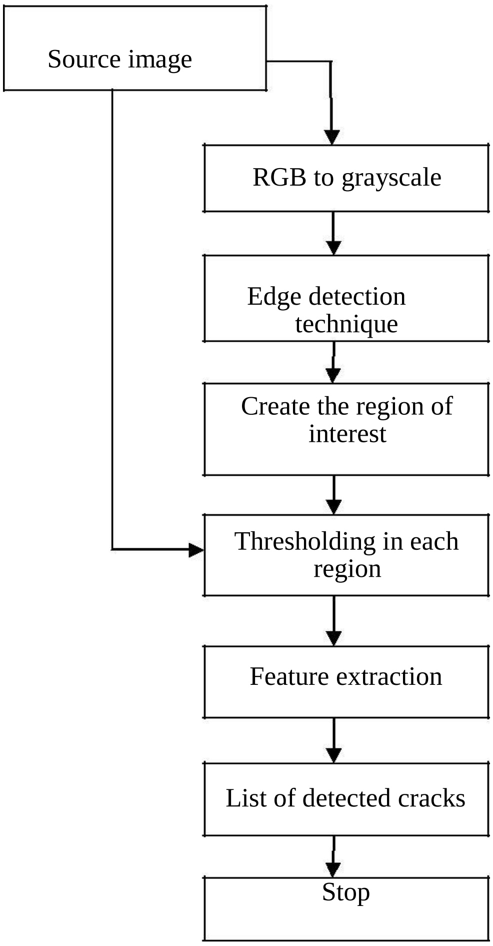



Fig.2.1 Triangulation method

Once the x- and y-coordinates have been determined, the z-coordinates have to be added. First, a "array" is created by rotating the 2D line data around the y-axis. The y-coordinate will be kept, as it is the point that the others are based off of (the rotation is around the y-axis). The x-coordinate that was previously recorded is equal to x(cos(r)), as it takes the original x-position, and rotates according to Fig. 2.1. It can be clearly seen how the x-coordinate becomes x(cos(r)). Because Once all of the points have been made to form the point cloud, they still must be made into a usable 3D model. The first process that takes place is the generation of the mesh.

Although there are many ways to do this, the general idea is to create a region with every single point, such that the regions are all connected with exactly one point-per-region. Once a mesh has been generated, many things can still be fixed. One issue is occlusion; it is common that part of the object will be lost, frequently because the laser is blocked by other parts of the object. This can be fixed by simple smoothing if there is a small region missing, or by being solved as 3D equations for the larger holes. Distortion is also another issue, which is easily fixed. Usually it affects the entire model, so uniform transformations of the points can solve this problem. Smoothing is used for the entire model, so that it is not full of very small jagged points all over. Smoothing reduces differences between points, with nearby points making big differences, and points with increasing distance from the point being examined making less of a difference. This is done to all points in the point cloud. All of these correction techniques are built into the Matlab software and can be easily implemented .Also algorithm for 3D mapping technique is given below:




## III. CONCLUSION

The developed algorithm performed relatively well. It can, in a robust way, detect crack indications, but with a number of false responses as well. It is clear that many of the false indications disappear/appear depending on the viewing angle while the true indication stays detected in many consecutive images. It can also be seen that a number of false indications stay detected in the sequence, most of which have to do with the geometry of the connection rod, and could be eliminated based on the position when mapped to the 3D model.

## IV. REFERENCES

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