Abstract

There are a number of precise measurement and inspection applications, which are based on focused scenes. Focusing is a major step to accomplish these applications, especially when microscopic images are required.

Microscopic manual focusing based on expert's eye could result in misleading decisions since it is subjected to human accuracy, sensitivity and visual capabilities. Therefore, automatic focusing systems have been developed to increase accuracy with better reliability and save time.

In this research, an auto focusing mechanical module with integrated software is designed, tested and verified. This system is based on grasping a sequence of images using coarse and fine focusing mechanisms. The most focused image is identified through an algorithm, which encapsulates various focusing approaches. These approaches are Image Curvature (CURV), Tenengrad based algorithms (TENG), Squared Gradient (GRAS) and Grey Level Variance (GLV).

Part of the aim of the presented research is making a comparison between these approaches to select the most appropriate when used with microscopic images of cast iron specimens. The proposed auto focusing module is a step towards the automation of manual focusing systems in microscopes.

Afterwards, image regeneration technique called image stitching had been applied to overcome the focusing defects of the automated microscopic system. The aim of this technique is to generate a new fused image from a set of focused images produced by the fine movement of the microscope. The new generated image is hard to be produced by the microscope and it will have a FV higher than that of the most focused image produced by the fine tuning of the microscope.

Graphical user interface (GUI) had been developed to facilitate the process for the human operator. The developed user interface called Intelligent Microscopic System – IMS is divided mainly into two sections. One section for image focusing, which is responsible for figuring out the most focused image using the microscopic system while the other is for image regeneration, which is responsible for generating the new stitched image.