Automated thresholding in radiographic image for welded joints

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Automated detection of welding defects in radiographic images becomes non-trivial when uneven illumination, contrast and noise are present. In this paper, a new surface thresholding method is introduced to detect defects in radiographic images of welding joints. In the first stage, several image processing techniques namely fuzzy c means clustering, region filling, mean filtering, edge detection, Otsu’s thresholding and morphological operations method are utilised to locate the area in which defects might exist. This is followed by the implementation of inverse surface thresholding with partial differential equation to locate isolated areas that represent the defects in the second stage. The proposed method obtained a promising result with high precision.

Keywords: nondestructive testing; welded joints; surface thresholding; fuzzy c means clustering

Introduction

Products made of polymer and metal are subjected to test and evaluation before they are considered safe to be used. One of the parts that deserve thorough scrutiny is the welded joints that hold the metal structure together. Consequently, industrial radiography is used as one of the nondestructive techniques to evaluate the quality of the welded joint. The advancement in computer technology spurs the use of image analysis and pattern recognition systems to assist the human interpreter in assessing the radiographed image in an automated manner. The purpose of the radiographic interpretation is to arrive at a decision on the acceptability or rejection of the component being assessed. This is based on the adopted code and standard in use, for example ASME Code Section 1 [1]. There are many types of discontinuities as described by the standard, which include cracks, lack of weld penetration, lack of weld fusion, porosity, void and others. The objective of this work is to develop an algorithm that automatically locates discontinuities that exist in radiographic images of welded joints.

Algorithms used for detecting discontinuities in weldment usually comprise a number of steps. These steps may constitute pre-processing, segmentation and classification. The segmentation step is crucial as the result from this stage strongly influences the final quality of interpretation [2]. In this step, features of the objects of interest such as welding defects are extracted and separated from the background. Usually, the area in which welding defects in radiographic images are present has lower intensity than the