INDEX

INTRODUCTION

Image thresholding is a necessary task in some image processing applications. The result of image thresholding is not always satisfactory. In recent years, various researchers have introduced new thresholding techniques based on fuzzy set theory to overcome this problem. Different fuzzy thresholding techniques have been developed to remove the ambiguity during the task of threshold section. It is a challenging task due to high uncertainties present in the image. In this project we will design a new threshold technique to segment the object from background in the Non-Destructive Testing(NDT) images. To handle the uncertainties in the NDT images we will use type II fuzzy set.

Nondestructive testing (NDT) is the process of inspecting, testing, or evaluating materials, components or assemblies for discontinuities, or differences in characteristics without destroying the serviceability of the part or system. [1]In other words, when the inspection or test is completed the part can still be used. [2] In contrast to NDT, other tests are destructive in nature and are therefore done on a limited number of samples ("lot sampling"), rather than on the materials, components or assemblies actually being put into service.

We often have to threshold gray-level image into binary image. In this case the image contains a background and one or more objects.[3] The simplest thresholding methods replace each pixel in an image with a black pixel if the image intensity is less than some fixed constant T (that is, $Iij > T$), or a white pixel if the image intensity is greater than that constant. Image thresholding can be regarded as the simplest from segmentation.[4]

Fuzzy techniques are suitable for developments of new algorithms because they are, as nonlinear knowledge best methods, able to remove ambiguities in a robust way.[5] In this project a new thresholding technique will be introduced which processes threshold as Type II fuzzy sets. Under this project fuzzy thresholding one should distinguish between different pixel classification techniques.[7]Type II fuzzy sets and systems generalize standard Type-1 fuzzy sets and systems so that more uncertainty can be handled.[6]

Non-destructive testing images is a challenging task due to high uncertainties present in the images. In this project our objective is to user computer vision technique for NDT, so in this project we will segment NDT images efficiently. So, in this method may fail to segment the NDT images. In this project we will design a thresholding technique to segment the object from background in the NDT images, and to handle the uncertainties in the NDT image we will use fuzzy II technique.

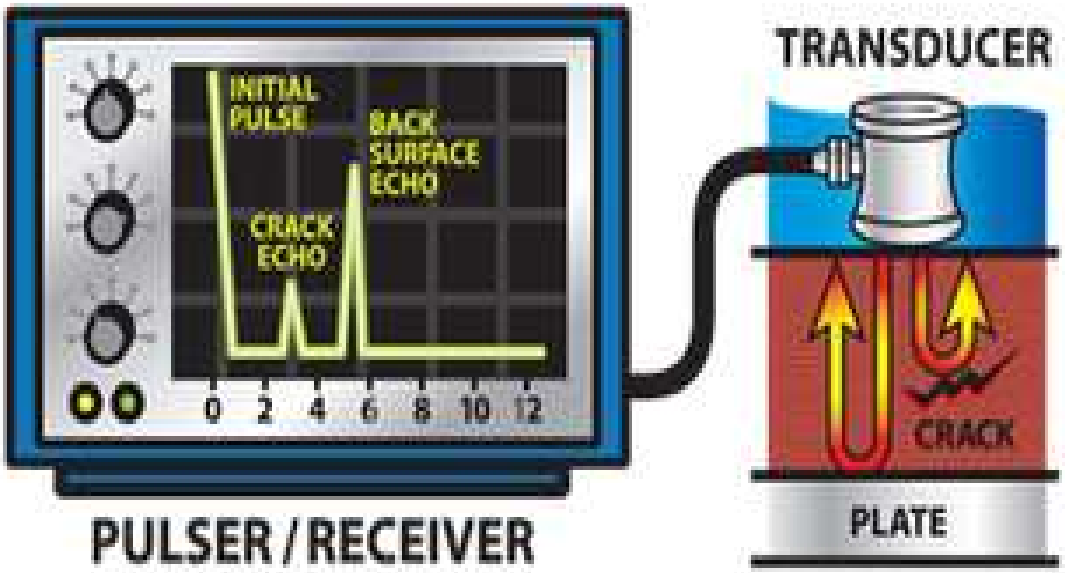
NON-DESTRUCTIVE TESTING

Non-destructive testing (NDT) is a wide group of analysis techniques used in science and technology industry to evaluate the properties of a material, component or system without causing damage. In this testing they can see any defect inside the image by using thermal camera but it is very difficult to segment because it has high uncertainties. It is a highly valuable technique that can save both money and time in product evaluation, and research. NDT is commonly used in forensic engineering, mechanical engineering, petroleum engineering, electrical engineering, civil engineering, systems engineering, aeronautical engineering, medicine, and art. Nondestructive testing (NDT) is the process of inspecting, testing, or evaluating materials, components or assemblies for discontinuities, or differences in characteristics without destroying the serviceability of the part or system. In other words, when the inspection or test is completed the part can still be used. In contrast to NDT, other tests are destructive in nature and are therefore done on a limited number of samples ("lot sampling"), rather than on the materials, components or assemblies actually being put into service. These destructive tests are often used to determine the physical properties of materials such as impact

resistance, ductility, yield and ultimate tensile strength, fracture toughness and fatigue strength, but discontinuities and differences in material characteristics are more effectively found by NDT. Today modern nondestructive tests are used in manufacturing, fabrication and in-service inspections to ensure product integrity and reliability, to control manufacturing processes, lower production costs and to maintain a uniform quality level. During construction, NDT is used to ensure the quality of materials and joining processes during the fabrication and erection phases, and in-service NDT inspections are used to ensure that the products in use continue to have the integrity necessary to ensure their usefulness and the safety of the public .Various national and international trade associations exist to promote the industry, knowledge about non-destructive testing, and to develop standard methods and training. These include the American Society for Nondestructive Testing, the Non-Destructive Testing Management Association, the International Committee for Non-Destructive Testing, the European Federation for Non-Destructive Testing and the British Institute of Non-Destructive Testing.It should be noted that while the medical field uses many of the same processes, the term "nondestructive testing" is generally not used to describe medical applications.

EXAMPLE OF NDT TESTING

NON-DESTRUCTIVE TESTING



WHY WE USE NDT IMAGES?

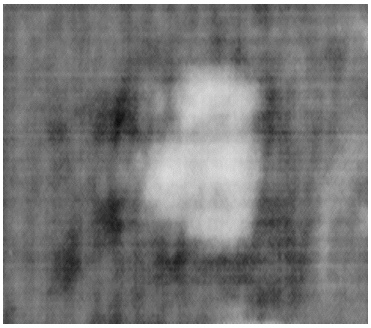
- NDT Image segmentation is very difficult because it has high uncertainty. This is the work of mechanical but they need an expert to examine the defect. But now a day's researcher are using the image processing. So, it can detect the fault in the image without taking help of any expert.
- Use of image processing technique, we are helping them that we can automatically finding the defect with the help of the computer. This is a case of automation. It is very easier to them.

THRESHOLDING

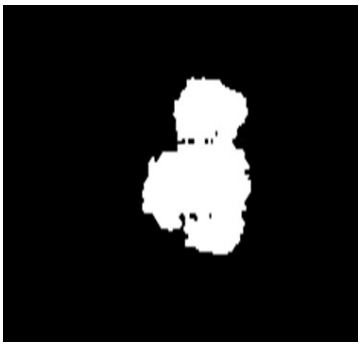
Thresholding is one of the old, simple and popular techniques for image segmentation and it is one of the most popular tools for image segmentation which consists of classification of the pixels as belonging to either the set of background pixels or the set of object pixels. Thresholding creates binary images from grey-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one. Thresholding can be done based on global information (that is called grey level histogram of the entire image) or it can be done using local information (that is co-occurrence matrix) of the image. Under each of these schemes if only one threshold is used for the entire image then it is called global thresholding when the image is partitioned into several sub regions it is referred to as local thresholding. It classified as bi-level thresholding and multithresholding. In bi-level image partitioned into two region-object(black) and background(white). When the image is composed of several objects with different surface characteristics one needs several thresholds for segmentation known as multithresholding.

example of THRESHOLDING (image processing):-

ORIGINAL IMAGE



THRESHOLD IMAGE



TYPE II Fuzzy sets

The term of fuzzy set was introduced with the 1965 proposal of fuzzy set theory by Dr. Lofty Zadeh of the University of California at Berkeley. Recent advances in the fuzzy set theory provide the possibilities for developing new image segmentation techniques. Fuzzy models are capable to handle uncertainties in the images and hence can improve the selection of optimal threshold for better image segmentation. A fuzzy set has a graphical description that expresses how the transition from one to another takes place. This graphical description is called a membership function.

Type II is the higher version of type I. It can handle uncertainties more efficiently.

A type II fuzzy set ˜*A* is defined by a type II

membership function *μ ˜A(x, u)*, where *x* ∈*X* and *u* ∈*Jx*⊆[0, 1], that is [30]

˜*A*= {*((x, u), μ ˜A(x, u))*| ∀*x* ∈*X*, ∀*u* ∈*Jx*⊆ [0, 1]},in which 0<=˜*A(x, u)*_1. ˜*A* can also be expressed in theusual notation of fuzzy sets as

˜*A*=f*x*∈f*Xu*∈*Jx μ ˜A(x, u)/(x, u) , Jx*⊆ [0, 1],

where the double integral denotes the union over all *x* and *u*.

In order to define a type II fuzzy set, one can define a type

I fuzzy set and assign upper and lower membership degrees

to each element to (re)construct the footprint of uncertainty

A more practical definition for a type II fuzzy set

can be given as follows:

˜*A*= {*(x, _U(x), _L(x))*|∀*x* ∈*X*,

μL(x)<=μ*(x)*<=μ*U(x), μ*∈ [0, 1]}.

The upper and lower membership degrees _*U* and _*L* of

initial (skeleton) membership function _ can be defined by

means of linguistic hedges like *dilation* and *concentration*:

_*U(x)* = [_*(x)*]0.5,

_*L(x)* = [_*(x)*]2.

Of course, other linguistic hedges such as *deaccentuation*

and *accentuation* can also be employed:

_*U(x)* = [_*(x)*]0.75, (9)

_*L(x)* = [_*(x)*]1.25. (10)

Hedges are generally available as pairs, which represent diagonally

different modifications of a basic term. It seems,

therefore, practical to use a linguistic hedge and its reciprocal

value to draw the footprint of uncertainty. Hence,

the upper and lower membership values can be defined as

follows:

_*U(x)* = [_*(x)*]1/_, (11)

_*L(x)* = [_*(x)*]_, (12)

where _ ∈*(*1,∞*)*. In the conducted experiments, _ ∈*(*1, 2]

has been used because α>2 is usually not meaningful for image data.

The purpose of type II fuzzy techniques is removed image ambiguity , which the ambiguity it is very difficult to determine the true location of object and background. This project we use fuzzy set to reduce the ambiguity and segment the object from the background property.

<u>The mathematical forms of the above mentioned mapping functions are given below</u>:

The most common measure of fuzziness is the linear index of fuzziness. For an M*N image subset A subset of X with L gray level g∈[0,L-1],the histogram h(g) and the membership function $\mu_X(g)$the linear index of fuzziness $y_l$can be define as follows

$$y_l(A) = \frac{2}{MN}\sum_{g=0}^{L-1} h(g) * mn|\mu_A(g), 1-\mu_A(g)|\ldots\ldots\ldots(1)$$

For the special case, the fuzziness can be calculate as follows

$$y_l(A) = \frac{2}{MN}\sum_{i=1}^{M-1}\sum_{j=1}^{N-1} \min\left[\mu_A(g_{ij}, 1-\mu_A(g_{ij})\right]\ldots(2)$$

The figure (1) define the ->

$$\mu(g) = \left(\frac{g - gmin}{T - gmin}\right) \wedge \alpha$$

$g(g) = \left(\frac{gmax}{gmi}\right) \wedge \beta \quad , \quad g \leq gmin \; or \; g \geq gmax$

Where g is the gray level $g_{min} g_{max}$ the minimum and maximum gray level and $T \in [0, L-1]$ is a suitable constant. The linguistic hedges $\alpha \; and \beta \in (0, \infty)$ can be determined with respect to the statistical properties of the image histogram. however, the proper selection of parameters is not easy and can add more complexity to the algorithm at hand. Using a fuzzy number seems to be more natural seems we usually try to segment the image by means of a preferably single number.

Software required

"NON-DESTRUCTIVE TESTING IMAGE(NDT)THRESHOLDING" that helps to find out any error or defects in any constructions through a computerized system. In this computerized process we found the defect very firstly and we will design a thresholding technique to segment the object from background in the NDT images, and to handle the uncertainties in the NDT image we will use type II fuzzy set.

Software requirement: -

- MATLAB 2013 will be used for implementation with windows 7.

Hardware requirement: -

- Processor: Intel core(TM) 2 DuoCPU.
- Ram: 2GB
- Hard disk: 500 GB hard disk recommended for the primary partition.

LITERATURE STUDY

1. Inge Edler (1911–2001) used this technique primarily for the preoperative study of mitral stenos is and diagnosis of mitral regurgitation. he showed that reflected echoes of inaudible sound enabled bats to navigate.

2. R. Marini and P. Ranos proposed that industry the qualification and certification of personnel for Non-Destructive Inspection (NDI/NDT) is carried out in compliance with specific approved rules.

3. NASA proposed High speed digital imaging systems have come a long way from their film camera predecessors.

4. Mike Farley advice that the competence of those carrying out non-destructive testing is an essential pre-requisite for the achievement of quality and reliability.

5. T. Sezgin and Sankur (2004) proposed that to make thresholding completely automated, it is necessary for the computer to automatically select the threshold.

6. M. Luessi, M. Eichmann, G. M. Schuster, and A. K. Katsaggelos advice that Image thresholding is a very common image processing operation, since almost all image processing schemes need some sort of separation of the pixels into different classes.

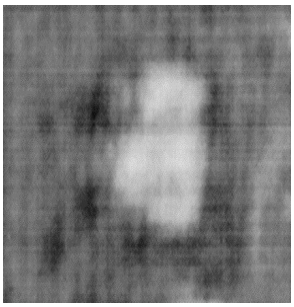
7. Lotfi A. Zadeh proposed fuzzy set theory permits the gradual assessment of the membership of elements in a set; this is described with the aid of a membership function valued in the real unit interval [0, 1].

8. N. N. Karnik and J. M. Mendel proposed that type-2 fuzzy sets are finding very wide applicability in *rule-based fuzzy logic systems* (FLSs) because they let uncertainties be modeled by them whereas such uncertainties cannot be modeled by type-1 fuzzy sets.

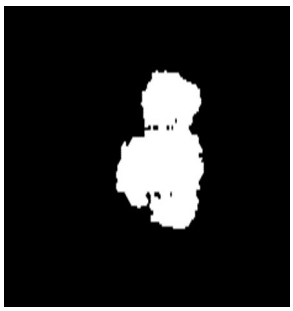
MOTIVATION

“NON-DESTRUCTIVE TESTING (NDT) IMAGE USING THRESHOLDING” that helps to find out any error or defects in any constructions through a computerized system that is in the entity image ambiguity exist, due to the ambiguity it is very difficult to determine the true location of object and background.This project we use fuzzy set2 to reduce the ambiguity and segment the object from the background property. In this computerized process we found the defect very firstly. This is a case of automation. It is a highly valuable technique that can save both money and time in product evaluation

ORIGINAL IMAGE



THRESHOLD IMAGE

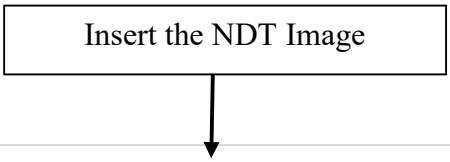


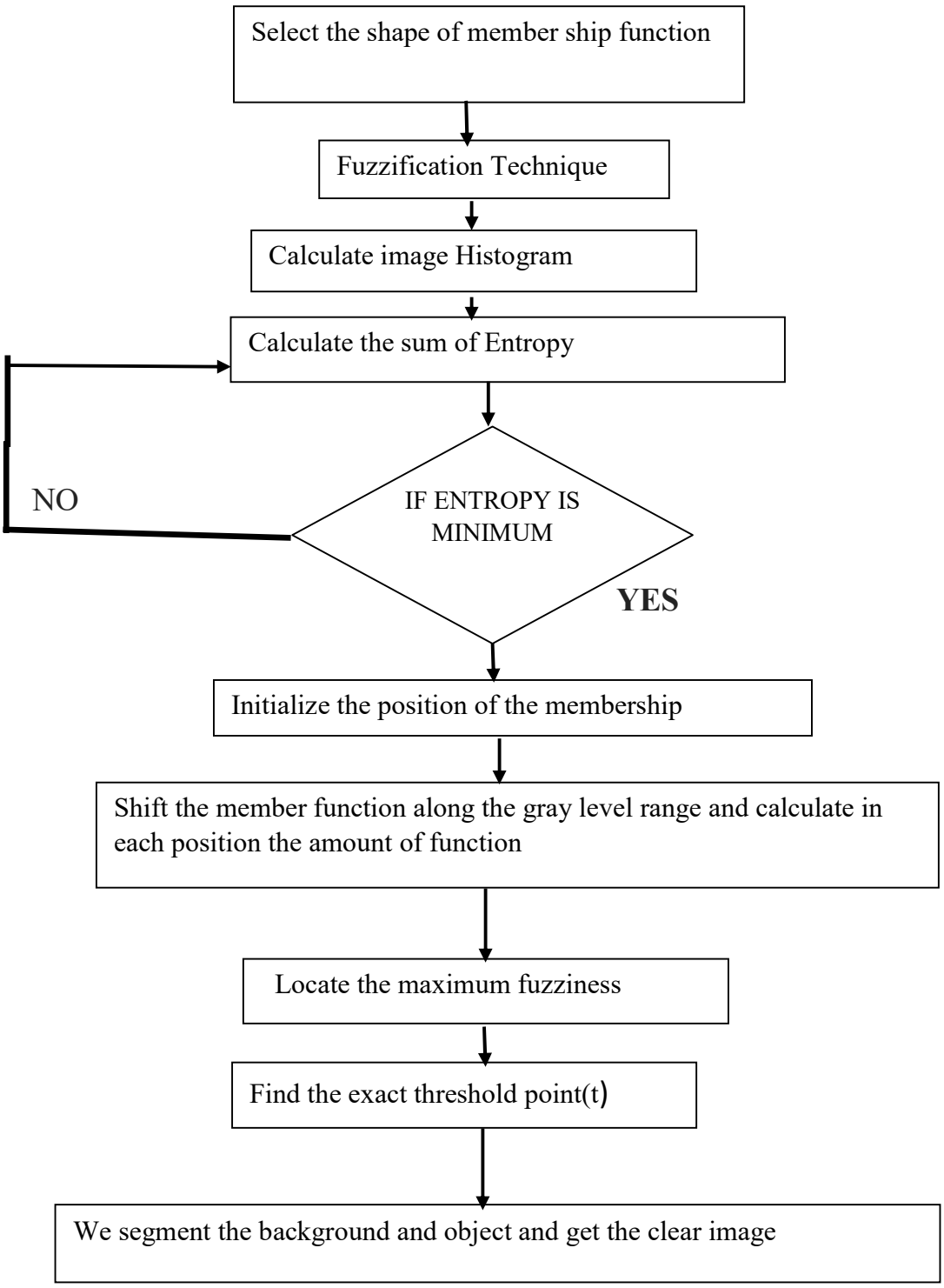
PLANNING

ALGORITHM: -

1. First insert the NDT image.
2. Select the shape of the membership function.
3. Select a suitable measure of Fuzzification technique. And also calculate the image histogram.
4. After step-3 calculate sum of the Entropy.
5. If Entropy is minimum then go to the next step else back to the Step-4.
6. After find the Entropy initialize the position of the membershipfunction.
7. Shift the membership function along the gray-level rang and
   Calculate in each position the amount of fuzziness.
8. Locate the position of maximum/minimum fuzziness.
9. Next, we find the exact Threshold point(t).
10. After that we segment the background and object.
11. so, finally we getthe clear image.

DESIGN:-(Flow Chart)

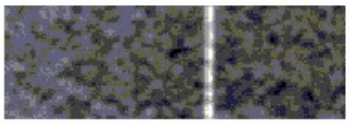



Select the shape of member ship function
Fuzzification Technique
Calculate image Histogram
Calculate the sum of Entropy
NO
IF ENTROPY IS MINIMUM
YES
Initialize the position of the membership
Shift the member function along the gray level range and calculate in each position the amount of function
Locate the maximum fuzziness
Find the exact threshold point(t)
We segment the background and object and get the clear image

RESULT

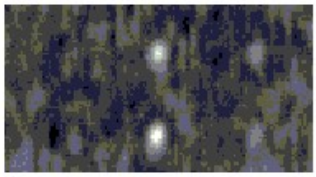
NTD helps to find out any error or defects in any constructions through a computerized system. In the entity image ambiguity exist, due to the ambiguity it is very difficult to determine the true location of object and background. this project we use fuzzy set to reduce the ambiguity and segment the object from the background property. In this computerized process we found the defect very firstly.

IMAGE 1



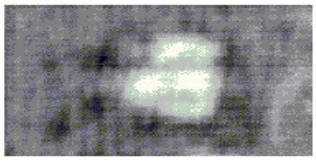
ORIGINAL IMAGE RESULT IMAGE

IMAGE 2



ORIGINAL IMAGE RESULT IMAGE

IMAGE3



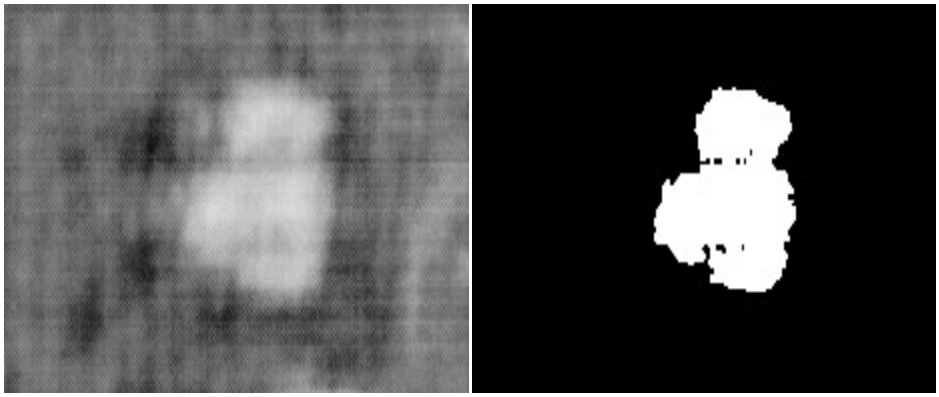
ORIGINAL IMAGE RESULT IMAGE

CONCLUSION

The aim of image enhancement is to improve the information in images for human viewers, or to provide `better' input for other automated image processing techniques. The main purpose of image thresholding is to bring out detail that is hidden in an image. It provides computerized process we found the defect very firstly. It is a highly valuable technique that can save both money and time in product evaluation.

NDT also plays very crucial role. By using this NDT tool we can easily detect the defects and its location and subsequently repair can be made wherever it is necessary to do so. By doing this we can prevent accidents which can be aroused due to these defects. This technology is having huge benefits and it should be used by every industry.

It helps in a great way to operate these industries economically, safely with high reliability and produce quality end-products which is the ultimate goal of any industry .



Original Image(a) Result Image(b)

REFERENCES

1. **www.google.com.**
2. **R. Marini and P. Ramos: "Current Issues in Qualification and Certification of Non-Destructive Testing Personnel in the Aerospace Industry", *ECNDT 2006 - Th.3.6.5***
3. **Bridges, Andrew. "High Speed Cameras for Non-Destructive Testing". NASA TechBriefs. Retrieved 1 November 2013.**
4. ***"ICNDT Guide to Qualification and Certification of Personnel for NDT" (PDF). International Committee for NDT. 2012.***
5. **Cartz, Louis [1995]. *Nondestructive Testing*. A S M International.**
6. **Charles Hellier (2003). *Handbook of Nondestructive Evaluation*. McGraw-Hill.**
7. **Introduction to Nondestructive Testing, The American Society for Nondestructive Testing.**
8. **Gonzalez, Rafael C. & Woods, Richard E. (2002). Thresholding. In Digital Image Processing.**
9. **Y.K. Lai, P.L. Rosin, Efficient Circular Thresholding.**
10. **L. A. Zadeh (1965) "Fuzzy sets".**
11. **D. Dubois and H. Prada (1988) Fuzzy Sets and Systems. Academic Press, New York.**