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Monitoring of Barnacle Growth on the Underwater Hull of an FRP Boat using Image Processing

S.B.Ismail[a,*], Salleh Z.[a,b]., M.Y.M.Yusop[a], F.H.Fakhruradzi[a]

[a]Universiti Kuala Lumpur Malaysian Institute of Marine Engineering Technology, Jalan Pantai Remis 32200 Lumut Perak, Malaysia
[b]*Centre of Excellence in Engineered Fibre Composites, University of Southern Queensland,Toowoomba QLD 4350, Australia*

Abstract

In this research, photos of barnacles were analysed using image processing. The images of barnacles were taken from the CITRA MOSTI boat made from fibre-glass reinforced plastic (FRP) for monitoring purpose. The photos were taken within a period of three (3) months. Results showed that the barnacles' growth in terms of their size and quantity might be due to the effect of saltwater. Results obtained through SCILAB programming were analysed and comprehensive data were tabulated. From images recorded on February 2013, it was observed that the barnacles had been growing aggressively achieving the highest pixel count of 3000 as compared to images captured in December that only amounted to 2600 pixels. The barnacles were growing at a rate of approximately 10% from the first image analysis. The highest recorded pixels were in the month of the March 2013, attaining about 3500 pixel counts. These changes in growth rate throughout the stipulated period may be due to numerous factors such as the fluctuating of seawater temperature and weather.

Keywords: barnacles; image monitoring; fibre-glass

1. Introduction

The oceans cover about two-thirds of the earth and have a great effect on the existence of all living beings. In the marine world, barnacles are considered as one of the major problems for marine vehicles such as boats, ships and sub-marines because they clings onto the underwater surfaces and removing them needs periodical blasting and

* Corresponding author. Tel.: +(605) 6909000; Fax: +(605) 6909091.
E-mail address: shaifulbakri@mimet.unikl.edu.my

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cleansing processes. Barnacle is a small saltwater animal with a protective shell-like covering as shown in Fig.1. There are more than 1,000 different species. Barnacles on the hull of a ship increases the drag of the vessel, thus the increase in friction can reduce the vessel's travelling speed. It also increases the fuel consumption to offset the higher friction created. The ship must then be put in a dry dock to have the bottom scraped. To prevent barnacles from clinging to ships, the hulls are either treated with toxic paint containing tin or copper or are coated with plastic. Almost all ships in the world are facing problems related to the breeding of barnacles on the hull surface.

Fig. 1. Photo of Barnacles growth at hull boat[1]

This problem is also known as marine fouling. Marine fouling is of major importance in shipping – impacting on ship performance, economy and the environment[1]. Since monitoring barnacle growth is difficult, the use of computers for simulation and data analysis has become a popular choice throughout many engineering disciplines. There are various applications of image processing e.g. detection of surface defects in industrial quality control, detection of anatomical landmarks in surgery, counting cells in biotechnology and classification of regions in remote sensing. Images are generated by optical cameras, ultrasound, x-ray machines and other imaging devices. When processing an image with a computer, it must be digitized or created in a digital format[2]. There are some basic methods to distinguish between objects and background and to describe regions in digital images.

SCILAB is a free software alternative to MATLAB, hailed very often as the language of technical and scientific computing[3]. MATLAB has found a permanent place not only in the curriculum of applied science and engineering studies, but also in research and development arena. SCILAB has similar functionalities as MATLAB and may be considered to be an effective alternative since it also provides a rich collection of tool boxes. In particular, the SCILAB Image Processing Design Toolbox (IPD) has various applications that are suitable for image processing. These include some basic methods to distinguish between objects and background and to describe the different regions in digital images.

In this research the photo of barnacles on the underwater hull surface were analysed using SCILAB. This surface is very important because it is in constant contact with the water and this is where the undesirable additional friction occurs. The photos of the barnacles were taken once a month.

2. SCILAB Image Processing Tool

SCILAB is a free software and user-friendly alternative to the commercial MATLAB package. SCILAB has as much functionality as compared to MATLAB. SCILAB has many collections of tool boxes suited for applications in science and technology fields. Image Processing Design Toolbox (IPD) is an image processing toolbox, which supports formats like BMP, PNG, JPEG, TIFF, and PBM[4]. It can do a variety of applications like image type conversion, spatial transformation functions, image analysis and statistical functions, image arithmetic functions, linear filtering, morphological operations, and colour space conversions[5].