ABSTRACT

In this chapter, authors propose a new method for improving detection probabilities of the defect inspection in quality control on the FRP product surface. The proposed method has improved the detection probabilities by using the joint probabilities of dual attributes with correlation for multiple perceptions. In order to obtain the improving detection probability, three kinds of attributes: size, aspect ratio, and color density are prepared in experiments. The experiments were performed by the paired comparison under constant stimuli. The result of our experiment qualitatively shows that the improving ratio of detection probabilities for dual attributes: P12, P23, P31 respectively rise approximately 21%, 26% and 24% for the mean in the case of dual attributes experiments. In addition, detection probabilities to be obtained by the method for multiple perceptions such as using dual attributes experiment were improved approximately 28% in comparison with the detection probability of past single attribute. These results showed this method was effective in raising detection probability for multiple perceptions.

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1. INTRODUCTION

In a progress of a current science and technology, it is no exaggeration to say that the steady development of an instrument to measure or observe something about an object serves an important role. In particular there is the progress of a measuring method for a physical hard object of single attribute such as the measure of length, weight, strength in a material, microscope, telescope, illuminometer, thermometer, and other visibility method. On the other hand, the progress of measuring method or evaluation technique in the soft object such as sensor networks (Delsing & Lindgren, 2005), ubiquitous computing (ubicomp)(Weiser, 1991; Weiser, 1993; Bell & Doursh, 2007), disappearing computer (Streitz et al, 2007), high order sensation of human perception (Hayashi et al, 2000), quality assessment such as image it (Miyahara, 1988), and decision making for ambient intelligence (Saaty, 1980; Vargas, 1990) need to more strengthen the foundation in soft science and technology.

In addition, recently mixed multiple and conjunction measuring methods from a point of view multiple attribute have been hot issue since the progression for multiple attributes has been later than the single attribute measurement. In this study, drawing focus to multiple perceptions in the visual inspection system for defects on the product surface, we propose a new method to measure the multiple attributes for soft science and technology.

Recently, several kinds of image processing method have been applying to the automated visual inspection system for defects on the product surface (Chen & Su, 1996; Chin, 1982; Chin, 1988; Huang et al., 1992; Shirvaikar, 2006). One of the aims of this research is also in the development of the heuristic and simple method that is used in the judgment process in the automated visual inspection system instead of inspector. A sort capacity by human vision is extremely high-performance, therefore such a soft information processing to a sort of images has been regarded unfit on the computer which is good at digital information processing. On the other hand, a visual inspection process has been holding the problem in productivity, since the performance of a precision and a speed will be degraded by fatigue of the inspector. In order to meet these problems, some research works were tried for the standardization of an operation time of visual inspection (Morawski et al, 1992; Arani et al, 1984; Drury, 1972; Spitz & Drury, 1978), though it is not reached to the place which fixes a good evaluation measure, and research of productivity of the production system which consists of a process including such a human being has left lots of problems unresolved.

In the practical situation of quality control on visual inspection, a panel must decide the judgement of the quality by using one’s sensitivities for multiple attributes whether the quality of object is good or not. On the other hand, it is required in the field of automated visual inspection system to measure the characteristics of sensitivities for multiple attributes and to evaluate the detective probability when the multiple attributes were used for the judgement of inspection. In this case, it is an important viewpoint to obtain the skill of the professional sense that has the knowledge or skill. In order to meet these problems, a new trial is proposed for the evaluation of human ability on psychometric function. The standard sample was designed by means of paired comparison and constant stimuli. In order to evaluate the visual sensory properties of panel in the practical inspection task, the psychophysical experiment was performed to obtain the psychometric curves to evaluate the distinction probability of target object under the situation of various combinations of mixed dual attributes. This analysis is to obtain the psychometric curve and to estimate the parameters of detectable probability distribution by the experiment of standard sample for single attribute. It is also examined to estimate the correlation among the attributes of figure and to estimate the detection probabilities when the decision was made under the situation of multiple attributes.