Development of novel full-automatic magnetic particle testing equipment

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Abstract

Generally, the final judgment of defects detection in the magnetic particle testing is performed by visual inspection. But the quantitative inspection is difficult to check visually. In the magnetic particle testing, the quantitative inspection was realized by the image processing technique, not visually. We report on the novel automatic technique of the magnetic particle testing equipment applied to the car components.

1. Introduction

Car component is passed through processes such as the quenching and the correcting. The components sometimes generate the defects by the stress in each process. Therefore, important car components carry out magnetic particle testing. In forging products, when 1000 pieces of products are produced, one of products has a defect. In casting products, when 10000 pieces of products are produced, one of products has a defect. The products with defects must not be allowed to come onto the market. The magnetic particle testing which can be inspected quantitatively under a fixed condition is requested.

2. Configuration of the automatic magnetic particle testing equipment

The magnetization, inspection liquid and ultraviolet radiant intensity are important elements in the magnetic particle testing. It's important to manage the respective elements. Figure 1 shows the configuration of the automatic magnetic particle testing equipment that we propose this time. The inspection mechanism consists of the black lights with UV LED, CCD cameras, the LED for the backlight and the image processing part.

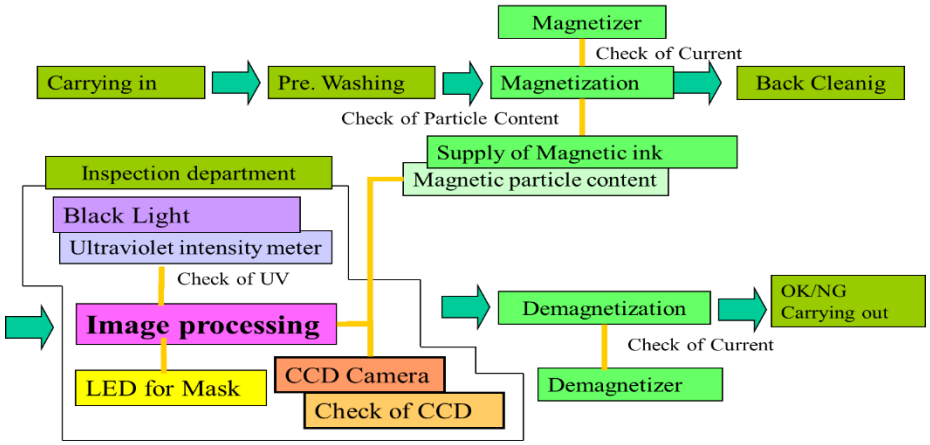

Figure 1. Configuration of the automatic magnetic particle testing equipment

3. Image processing technique in magnetic particle testing and results

A judgement of the flaw is to satisfy the following two conditions. As one of condition, the magnetic particle indication is to be more than 1 mm of length and linear. As the second condition, the length of the magnetic particle indication and the ratio of the width are to be more than three times. The magnetic particle indications are memorized by CCD camera as image data to the PC. We surely detect the brightness change certainly using the statistical method. The brightness change part is detected as the candidate for the flaw. The judgement of flaws is performed by the image processing according to the flow shown as figure 2. We confirmed the performance of the automatic magnetic particle testing using by steering rack bars of car component. The results are explained in detail below. Dimensions of the used rack bars are 500-800mm in length, 25-40mm in diameter. The flaw of the tooth surface part generates only radial direction. Therefore the magnetization used the coil magnetization technique. After performing to judge automatically by 150 pieces of sample products, the misjudgment rate was 0.064%. After automatic judging, 10 products which has a defect were detected all as a product with a defect.

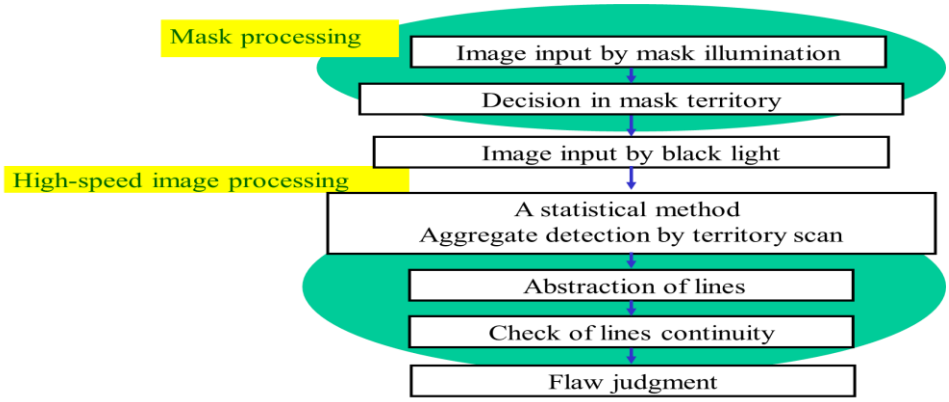

Figure 2. Automatic judgment flow by image processing

4. Conclusions

The requests to automation of the magnetic particle testing will rise from now on. We applied the image processing technique and reported on the automatic magnetic particle testing.

References

Hori, “Equipment of magnetic particle testing is assembly line”, Journal of the Japanese society non-destructive inspection, Vol. 65(11), pp564～569, 2016