

Shape measurement based on a combination of one-dimensional digital holography and lateral sample scanning

Yuma Sato and Yoshio Hayasaki

Center for Optical Research and Education (CORE), Utsunomiya University
7-1-2 Yoto, Utsunomiya 321-8585, Japan
sato_y@opt.utsunomiya-u.ac.jp

Digital holography is used in a wide range of fields, including medical science and biology, and one application is industrial measurement. Digital holography is a suitable technology for factory line inspection due to its non-destructive property, micrometer-order accuracy, and real-time performance. However, the measurement of shape using this technology in factories is time-consuming, which affects the speed of quality inspection on the production line. Therefore, we propose a method to reduce unnecessary point measurements by using one-dimensional image instead of two-dimensional image. This approach increases calculation speed and thus solves the inspection speed problem. In this study, we used a Michelson interferometer as the optical system. We provide an overview of the process. First, one-dimensional information is acquired using an image sensor. Next, we moved on to in-calculator processing. Here, we selected the Fourier transform method. The acquired one-dimensional interference fringe data is Fourier transformed to obtain a spectrum. After acquiring the first-order light, inverse Fourier transform is performed to obtain amplitude and phase information. By repeating this series of processes, a single image is finally acquired. Compared to two-dimensional input, the amount of data to be processed is overwhelmingly small.

Short biography:



Yuma Sato was born in 2001 in Oshu, Iwate Prefecture. Then he grew up in Iwate Prefecture until the age of 18. He graduated from Iwate Prefectural Mizusawa High School in March 2020 and entered the Faculty of Engineering at Utsunomiya University in April of that year. In 2021, he moved on to the Information Electronics and Optics Course in the Faculty of Engineering. He has been a member of Hayasaki Laboratory, Utsunomiya University's Center for Optical Research and Education (CORE) since this April. His research field is optical measurement using digital holography.