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Editorial

Geometrical Vision Measurement in Mechanical Engineering

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In the past decades, advances in mechanical engineering have resulted in greater use of vision measurement methods in optical metrology, such as time-of-flight, stereo vision, structured light vision, fringe projection technique, depth from focus, photometric stereo, and digital image correlation. Since the advantages are noncontact, nondestructive, high-precision, automatic, and fast, the vision measurement methods have played an important role in the fields of reverse engineering, online inspection, dimensional analysis, quality assurance, sorting, material handling, and optical gauging. With the rapid development of computer technology and digital image processing technology, more and more vision measurement methods will be applied in many areas of engineering and science. This special issue aims to collect basic theory, key technology, and application articles on the most recent achievements in geometrical vision measurement, for the purpose to show the latest development and provide guidelines of future research directions. There are five papers about the structured light vision technology: B. Wu and B. Wang established a mathematical model of the reference sphere positioning measurement based on the measuring principle of the line-structured light vision sensor; H. Gao et al. developed a novel 3D wide FOV scanning measurement system which adopted two multiline-structured light sensors; Z. Wei et al. proposed a sphere-based calibration method for line-structured light vision sensor; Y. Wang et al. discussed the pipe defect detection method based on inside 3D points acquired by circle structured light vision system; R. Marani et al. presented a high-resolution laser scanning vision system for the inspection of drilling tools. Apart from the structured light vision method, there are also four papers dealing with the problems in the stereo/multiple vision: J. Lin et al. presented a novel 3D profile automated reconstruction technique based on stereo vision for objects with complex free-form surface or step surface; Y. Guo et al. presented a real-time measurement method for the 2-DOF swing angles of rocket nozzle by the use of multivision and rocket nozzle rotation axes; C.-C. Ho et al. presented a real-time image capturing system that uses four cameras at 30 fps and stitches their views together to create a panoramic video; T. Xue et al. provided a segmentation method for multibubbles in gas-liquid two-phase flow based on virtual stereo vision and the characteristics of three-dimensional trajectory of bubbles are measured accurately. In addition, there are three papers related to the image processing and pattern recognition: M. Dong et al. derived a general algorithm for grayscale-weighted centroiding method; X. Chen et al. described a direction-guided method for real-time processing of light stripe images in practical active vision application; Z. Wang et al. proposed a manifold adaptive kernel semisupervised discriminant analysis algorithm for gait recognition. The rest of the five papers discussed other issues related to the vision measurement: A. B. Abdullah et al. aimed to evaluate the quality of a cold embossed hole based on profile deviation gathered from 3D surface measurement; W. L. Liu et al. developed a dynamic weighting model that describes not only the dynamic uncertainty but also the geometric variations of laser tracking system; Y. Wang et al. presented a new method to calibrate the robot visual measurement system; H. Wang presented a technique for noncontact optical measurement of in-plane displacement based on correlation analysis; B. Wu and B. Wang presented a novel automatic measurement

method for large-scale space and large workpieces (equipment) combined with the laser theodolite measuring and vision guiding technologies. We hope that this special issue would provide the readers with the latest trends of geometrical vision measurement in mechanical engineering.

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