Wei Tao

Shanghai Jiao Tong University
China

Structural Laser Intelligent Measurement Technology and Its Application in Special Environments

Abstract:

Structural laser measurement technology plays an important role in precision measurement, and the rapid development of artificial intelligence provides it with more application potential, especially for applications facing special environments. This report mainly focus on the measurement principles of structural lasers with different measurement dimensions of "point-line-surface", combined with cutting-edge intelligent algorithms and machine learning methods to improve the overall performance of structural laser measurement systems, and applied to various special environments. Firstly, heuristic intelligent optimization algorithms are adopted to optimize the structural parameters of the optical system so as to improving the design efficiency. An illumination distribution model for the full process of "laser emission-transmission-imaging" is established, which helps to determine the optical structural parameters corresponding to the optimal sensitivity under the condition of spatial constraints, and high uniform and stable light source modules are also designed. Secondly, in response to data dither and loss caused by temperature, dust, vibration and other variations in special environments, deep learning and semi-supervised learning algorithms are combined to denoise laser images. And the three-dimensional point cloud holes are repaired using Riemann manifolds and Bayesian estimation to improve stability in extremely complex environments. Finally, this report introduces typical application cases of structural laser intelligent measurement technology in special environments, including high-precision industrial manufacturing assembly, seawater surface roughness measurement, aerospace load attitude measurement and so on.

Biography

Wei Tao is now a professor of Shanghai Jiao Tong University. Her research fields include optical precision measurement method, development and calibration of high-precision photoelectric sensor. She has published 100 research papers, and been authorized more than 30 Chinese invention patents. She is now a member of IEEE Instrumentation and OSA. She is also a committee member of China Instrument and control Society. She has won 5 awards in her research area of laser sensors.