
Methods for estimation of coordinate measurement uncertainty of multichannel 3D imaging systems

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This article examines the problem of the multichannel 3D imaging system design on the system level of the top-down design procedure. We develop the mathematical model of this system and propose the performance criterion. The influence of every component of the system on the overall performance criterion is evaluated in an analytical form. Analytical expressions for the estimation of the covariance matrix for 3D coordinate measurement error in the limit of small noise are verified by the results of computer simulation for the system including one projector unit and two camera units. We offer the method for the analysis of 3D object registration uncertainty in the working volume of the system with known parameters of devices and algorithms. The method for the verification of the results by means of statistical simulation is also proposed.

Keywords: 3D scanner, structured light, stereo correspondence, uncertainty evaluation, design technique.

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