Moiré Topography for Medical use

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This dissertation studies and develops various techniques of moiré topography for medical use, where measurement of human body shape is required.

The identification of the concavity and the convexity of portions of an object with contour lines composed of closed loops has been a problem in the application of moiré topography.

First, conventional moiré techniques are reviewed and directionality of moiré fringes formed by the Windischbauer type three-dimensional grating is studied analytically and experimentally. It is found that directional fringes can be obtained only for large angles of separation between illumination and observation, which limits the practical application of the Windischbauer type grating. Then a new type of three-dimensional grating, called one-and-three-thread is proposed and studied analytically and experimentally. This method can produce directional moiré fringes at small angles of separation, which is disirable in clinical application of this technique. In addition, the two-frequency moiré topography technique is proposed. This method enables one to determine absolute order of moiré fringes directly from a photograph, from which one can identify the concavity and the convexity of local curvature. This technique is suitable for collecting data of unknown shape such as a deformed human body without ambiguity. Another technique, called square grid projection method, is also proposed for the three-dimensionsional shape measurement.

Several examples of the field applications of the various techniques of moiré topography, such as the measurement of the funnel chest deformities are presented to show the effectiveness of the techniques.