Light Science & Applications

3D shape measurement based on statistical pattern projection

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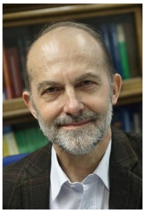
Non-contact optical 3D measurement methods occupy a major place in industrial metrology, but also in many other areas of science and technology. In particular, structured light methods play a significant role. So, fringe projection is established for a long time, which is why it is often used as a reference method for other optical 3D measurement methods. In addition, methods that work with the projection of statistical patterns are becoming increasingly important. This is mainly since, compared to fringe projection, statistical patterns can be generated more easily and usually also projected faster, so that the measurement speed is no longer limited by the projection system. An important example is the combination of stereophotogrammetry with statistical pattern projection, in which the 3D reconstruction is performed primarily by means of temporal correlation methods. Since the statistical patterns do not need to be known in terms of their actual structure, it is possible to switch to new projection methods and thus significantly increase the speed of measurement. Both incoherent band-limited and coherent patterns (laser speckles) can be used as statistical patterns. For pattern projection, laser speckles offer the advantages of high contrast and spectral narrowband. A key point for the further establishment of these 3D measurement methods, especially in the industrial sector, is the creation of possibilities for measuring objects that behave uncooperatively in the visible spectral range (VIS). These include, but are not limited to, transparent and reflective objects. This is where the transition to IR or UV wavelengths can be a solution. The physical and technical design of 3D measuring systems often involves compact and miniaturized systems. One way to do this is with single-camera systems, which then require, for example, the repeatable projection of the patterns. Indispensable for the successful establishment of these 3D measurement methods is a precise characterization of their parameters and the comparison with established measurement methods.



Short Bio:

Richard Kowarschik received his diploma degree and his Dr. rer. nat. in Physics and Dr. habil. degrees from the Friedrich Schiller University, Jena, Germany, in 1973, 1977, and 1991, respectively. He accepted the Chair of Experimental Physics/Coherent Optics in 1992 and was the director of the Institute of Applied Optics at the Friedrich Schiller University between 1990 and 2016. He was the president of the German Society for Applied Optics between 2000 and 2004.