DEVICE FOR IMAGING THROUGH AN OPTICAL SYSTEM TO BE TESTED, AND SYSTEM AND METHOD FOR TESTING AN OPTICAL SYSTEM

[0001] The invention relates to a device for imaging by an optical system to be tested, and a test system and a method for testing an optical system.

[0002] In order to measure an imaging quality of an optical system on the basis of a modulation transfer function, an object can, for example, be imaged onto a sensor via the optical system to be tested, and a calculation of the modulation transfer function can be made on the basis of an intensity distribution received by the sensor. A two-dimensional measurement of the modulation transfer function, which is performed due to a focus shape that is often not rotationally symmetrical and with a conventional test structure being used, can however usually be accompanied by increased sensor noise. Conventional test structures include, for example, a so-called slit reticule or a slit-shaped test structure, a so-called cross reticule or a cruciform test structure, a so-called pinhole reticule or a punctiform test structure, or a so-called H reticule or an H-shaped test structure.

[0003] Against this background, the approach presented here presents an improved device for imaging by an optical system to be tested, an improved test system for testing an optical system, and an improved method for testing an optical system and also a use of such a device for testing an optical system according to the main claims. Advantageous embodiments and developments of the invention result from the following dependent claims.

[003a] According to a first aspect of the present invention, there is provided a test system for testing an optical system, wherein the test system has the following features: a device for imaging by the optical system to be tested; and an evaluation device. The device comprises a first device portion having a first transmittance for electromagnetic waves and a second device portion having

a second transmittance for the electromagnetic waves. The second transmittance is higher than the first transmittance, and at least one of the device portions is ring-shaped. One of the ring-shaped device portions is shaped as a slit or ring gap. The evaluation device is designed to evaluate an image representation of the entire device generated by the optical system to be tested, in order to determine an evaluation result for the testing of the optical system.

[0004] According to embodiments, a device for imaging by an optical system to be tested or, in other words, a test structure for measuring an imaging quality of an optical system, can in particular be provided with the aid of a modulation transmission function, contrast transmission function, or modulation transfer function (MTF). The device or test structure can have a geometrically annular

Claims

1. Test system for testing an optical system, wherein the test system has the following features:

a device for imaging by the optical system to be tested, wherein the device comprises a first device portion having a first transmittance for electromagnetic waves and a second device portion having a second transmittance for the electromagnetic waves, wherein the second transmittance is higher than the first transmittance, wherein at least one of the device portions is ring-shaped; and an evaluation device,

wherein

one of the ring-shaped device portions is shaped as a slit or ring gap, wherein the evaluation device is designed to evaluate an image representation of the entire device generated by the optical system to be tested, in order to determine an evaluation result for the testing of the optical system.

2. Test system according to claim 1, wherein the second device portion is ring-shaped, wherein the second device portion is arranged between a first partial region and a second partial region of the first device portion.

3. Test system according to claim 1, wherein the first device portion is ring-shaped, wherein the first device portion is arranged between a first partial region and a second partial region of the second device portion.

4. Test system according to any of claims 1 to 3, wherein the evaluation device is designed to determine a two-dimensionally measured modulation transfer function of the optical system as the evaluation result using the image representation of the device generated by the optical system to be tested.

5. Test system according to any of claims 1 to 4, wherein the evaluation device is designed to determine an effective focal length and/or a direction-dependent magnification capability of the optical system as the evaluation

result using the image representation of the device generated by the optical system to be tested.

6. Method using a test system according to any of claims 1 to 5, wherein the method comprises the following steps:

generating an image representation of the entire device by means of the optical system to be tested; and

evaluating the image representation of the device in order to determine an evaluation result for the testing of the optical system.

7. Method according to claim 6, wherein in step of evaluating , using the image representation of the device, a two-dimensionally measured modulation transfer function of the optical system is determined as the evaluation result.

8. Method according to claim 7, wherein in step of evaluating , the two-dimensionally measured modulation transfer function is ascertained from a point spread function of the optical system, by means of a Fourier transform, wherein the point spread function is mathematically determined from a plurality of line spread functions of the optical system obtained in different cross-sectional planes.

9. Method according to any of claims 6 to 8, wherein in step of evaluating, using the image representation of the device, an effective focal length and/or a direction-dependent magnification capability of the optical system are/is determined as the evaluation result.