Claims

1. A measuring apparatus for measuring a modulation transfer function (MTF) of an afocal optical system, wherein the measuring apparatus has the following features:

a receiving device for receiving the afocal optical system in a receiving plane;

a light-providing device for providing light for illuminating the afocal optical system in the receiving device from a first side;

a camera for observing the afocal optical system in the receiving device from a second side opposite the first side for generating a camera image, wherein, in an operational state of the measuring apparatus, the light-providing device, the afocal optical system, and the camera are arranged coaxially on or with measurement axes parallel to a measuring axis oriented perpendicularly to the receiving plane;

at least one further light-providing device for providing further light for illuminating the afocal optical system in the receiving device from the first side;

at least one further camera for observing the afocal optical system in the receiving device from the second side for generating a further camera image; wherein, in the operational state, the further light-providing device, the afocal optical system, and the further camera are arranged coaxially on or with measurement axes parallel to an oblique measuring axis oriented obliquely to the measuring axis and/or the receiving plane; and

a transmission interface for transmitting the camera image and the further camera image to an evaluation unit, which is configured to identify the modulation transfer function (MTF) of the afocal optical system by using at least the camera image and/or the further camera image.

2. The measuring apparatus according to claim 1, in which the light-providing device has a focusable or a non-focusable collimator which is configured to provide the light as collimated light.

3. The measuring apparatus according to one of the preceding claims, having at least one third camera for observing the optical system in the receiving device from the second side for generating a third camera image and at least one third light-providing device for providing a third light for illuminating the optical system in the receiving device from the first side, wherein, in the operational state of the measuring apparatus, the third light-providing device, the optical system, and the third camera are arranged coaxially on or with measurement axes parallel to a further oblique measuring axis oriented obliquely to the measuring axis and/or the receiving plane and/or the oblique measuring axis.

4. The measuring apparatus according to one of the preceding claims, having at least one optical filter which is configured to change light, impinging on the optical filter, with a first wavelength range in order to provide the light with a changed, second wavelength range emerging from the optical filter, and/or which is configured to change light, impinging on the optical filter, with a first polarization in order to provide the light with a changed, second polarization emerging from the optical filter.

5. The measuring apparatus according to one of the preceding claims, having a camera holding device which has receiving units for receiving the cameras.

6. The measuring apparatus according to one of the preceding claims, having a light-providing holding device which has receiving units for receiving the light-providing devices.

7. The measuring apparatus according to claim 5 or 6, in which the camera holding device is arranged so as to be tiltable or tilted relative to the light-providing holding device, or the light-providing holding device is arranged so as to be tiltable or tilted relative to the camera holding device.

8. The measuring apparatus according to one of claims 5 through 7, in which the camera holding device and/or the light-providing holding device is arranged so as to be laterally movable.

9. The measuring apparatus according to one of the preceding claims, having a movement device which is configured to move the receiving device transversely to the measuring axis.

10. The measuring apparatus according to one of the preceding claims, having at least one aperture for the light and/or the further light.

11. The measuring apparatus according to one of the preceding claims, having the evaluation unit, which is configured to identify, using the camera image and/or the further camera image, a deviation in the modulation transfer function (MTF) and to determine, using the deviation, a correction value or a correction matrix for correcting the modulation transfer function (MTF) for increasing the imaging quality of the optical system.

12. The measuring apparatus according to one of the preceding claims, in which the camera and/or the further camera has a fixed or adjustable focus position.

13. The measuring apparatus according to one of the preceding claims, having a structural detection camera which is arranged to face the second side and configured to detect a predefined structure on the receiving plane or in a defined region around the receiving plane, wherein the evaluation device is configured to determine a lateral position of the optical system by using the detected predefined structure.

14. The measuring apparatus according to one of the preceding claims, in which the optical system is formed as an exit window, a display element, a waveguide, an optical filter, a camera lens, or binoculars.

15. A method for measuring a modulation transfer function (MTF) of an afocal optical system, wherein the method comprises the following steps:

providing light for illuminating, using a light-providing device, the afocal optical system, accommodated in a receiving plane in a receiving device, from a first side;

providing further light for illuminating, using a further light-providing device, the afocal optical system, accommodated in the receiving plane in the receiving device, from the first side;

generating a camera image of a reticle via the afocal optical system in the receiving device from a second side opposite the first side by using a camera, wherein the light-providing device, the afocal optical system, and the camera are arranged coaxially on or with measurement axes parallel to a measuring axis oriented perpendicularly to the receiving plane;

generating a further camera image of a further reticle via the afocal optical system in the receiving device from the second side by using a further camera, wherein the further light-providing device, the afocal optical system, and the further camera are arranged coaxially on or with measurement axes parallel to an oblique measuring axis oriented obliquely to the measuring axis and/or the receiving plane; and

identifying or calculating, using the camera image and/or the further camera image, the modulation transfer function (MTF) of the afocal optical system.