Claims

1. A ~~M~~measuring apparatus ~~(100)~~ for measuring a modulation transfer function (MTF) of an afocal optical system ~~(105)~~, wherein the measuring apparatus ~~(100)~~ has the following features:

a receiving device ~~(110)~~ for receiving the afocal optical system ~~(105)~~ in a receiving plane ~~(140)~~;

a light-providing device ~~(115)~~ for providing light ~~(145)~~ for illuminating the afocal optical system ~~(105)~~ in the receiving device ~~(110)~~ from a first side ~~(150)~~;

a camera ~~(120)~~ for observing the afocal optical system ~~(105)~~ in the receiving device ~~(110)~~ from a second side ~~(155)~~ opposite the first side ~~(150)~~ for generating a camera image ~~(160)~~, wherein, in an operational state of the measuring apparatus ~~(100)~~, the light-providing device ~~(115)~~, the afocal optical system ~~(105)~~, and the camera ~~(120)~~ are arranged coaxially on or with measurement axes parallel to a measuring axis ~~(162)~~ oriented perpendicularly to the receiving plane ~~(140)~~;

at least one further light-providing device ~~(125)~~ for providing further light ~~(165)~~ for illuminating the afocal optical system ~~(105)~~ in the receiving device ~~(110)~~ from the first side ~~(150)~~;

at least one further camera ~~(130)~~ for observing the afocal optical system ~~(105)~~ in the receiving device ~~(110)~~ from the second side ~~(155)~~ for generating a further camera image ~~(170)~~; wherein, in the operational state, the further light-providing device ~~(125)~~, the afocal optical system ~~(105)~~, and the further camera ~~(130)~~ are arranged coaxially on or with measurement axes parallel to an oblique measuring axis ~~(175)~~ oriented obliquely to the measuring axis ~~(162)~~ and/or the receiving plane ~~(140)~~; and

a transmission interface ~~(135)~~ for transmitting the camera image ~~(160)~~ and the further camera image ~~(170)~~ to an evaluation unit ~~(180)~~, which is configured to identify the modulation transfer function (MTF) of the afocal optical system ~~(105)~~ by using at least the camera image ~~(160)~~ and/or the further camera image ~~(170)~~.

2. The ~~M~~measuring apparatus ~~(100)~~ according to claim 1, in which the light-providing device ~~(115)~~ has a focusable or a non-focusable collimator ~~(500)~~ which is configured to provide the light ~~(145)~~ as collimated light.

3. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, having at least one third camera ~~(200)~~ for observing the optical system ~~(105)~~ in the receiving device ~~(110)~~ from the second side ~~(155)~~ for generating a third camera image and at least one third light-providing device ~~(205)~~ for providing a third light for illuminating the optical system ~~(105)~~ in the receiving device ~~(110)~~ from the first side ~~(150)~~, wherein, in the operational state of the measuring apparatus ~~(100)~~, the third light-providing device ~~(205)~~, the optical system ~~(105)~~, and the third camera ~~(200)~~ are arranged coaxially on or with measurement axes parallel to a further oblique measuring axis oriented obliquely to the measuring axis ~~(162)~~ and/or the receiving plane ~~(140)~~ and/or the oblique measuring axis ~~(175)~~.

4. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, having at least one optical filter which is configured to change light ~~(145)~~, impinging on the optical filter, with a first wavelength range in order to provide the light ~~(145)~~ with a changed, second wavelength range emerging from the optical filter, and/or which is configured to change light ~~(145)~~, impinging on the optical filter, with a first polarization in order to provide the light ~~(145)~~ with a changed, second polarization emerging from the optical filter.

5. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, having a camera holding device ~~(210)~~ which has receiving units ~~(215)~~ for receiving the cameras ~~(120, 130, 200)~~.

6. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, having a light-providing holding device ~~(220)~~ which has receiving units ~~(225)~~ for receiving the light-providing devices ~~(115, 125, 205)~~.

7. The ~~M~~measuring apparatus ~~(100)~~ according to claim 5 or ~~and~~ 6, in which the camera holding device ~~(210)~~ is arranged so as to be tiltable or tilted relative to the light-providing holding device ~~(220)~~, or the light-providing holding device ~~(220)~~ is arranged so as to be tiltable or tilted relative to the camera holding device ~~(210)~~.

8. The ~~M~~measuring apparatus ~~(100)~~ according to one of claims 5 through 7, in which the camera holding device ~~(210)~~ and/or the light-providing holding device ~~(220)~~ is arranged so as to be laterally movable.

9. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, having a movement device ~~(190)~~ which is configured to move the receiving device ~~(110)~~ transversely to the measuring axis ~~(162)~~.

10. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, having at least one aperture ~~(192)~~ for the light ~~(145)~~ and/or the further light ~~(165)~~.

11. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, having the evaluation unit ~~(180)~~, which is configured to identify, using the camera image ~~(160)~~ and/or the further camera image ~~(170)~~, 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 ~~(105)~~.

12. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, in which the camera ~~(120)~~ and/or the further camera ~~(130)~~ has a fixed or adjustable focus position.

13. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, having a structural detection camera ~~(197)~~ which is arranged to face the second side ~~(155)~~ and configured to detect a predefined structure on the

receiving plane ~~(140)~~ or in a defined region around the receiving plane ~~(140)~~, wherein the evaluation device is configured to determine a lateral position of the optical system ~~(105)~~ by using the detected predefined structure.

14. The ~~M~~measuring apparatus ~~(100)~~ according to one of the preceding claims, in which the optical system ~~(105)~~ is formed as an exit window, a display element, a waveguide, an optical filter, a camera lens, or binoculars.

15. A ~~M~~method ~~(1000)~~ for measuring a modulation transfer function (MTF) of an afocal optical system ~~(105)~~, wherein the method ~~(1000)~~ comprises the following steps:

providing ~~(1005)~~ light ~~(145)~~ for illuminating, using a light-providing device ~~(115)~~, the afocal optical system ~~(105)~~, accommodated in a receiving plane ~~(140)~~ in a receiving device ~~(110)~~, from a first side ~~(150)~~;

providing ~~(1010)~~ further light ~~(165)~~ for illuminating, using a further light-providing device ~~(125)~~, the afocal optical system ~~(105)~~, accommodated in the receiving plane ~~(140)~~ in the receiving device ~~(110)~~, from the first side ~~(150)~~;

generating ~~(1015)~~ a camera image ~~(160)~~ of a reticle ~~(185)~~ via the afocal optical system ~~(105)~~ in the receiving device ~~(110)~~ from a second side ~~(155)~~ opposite the first side ~~(150)~~ by using a camera ~~(120)~~, wherein the light-providing device ~~(115)~~, the afocal optical system ~~(105)~~, and the camera ~~(120)~~ are arranged coaxially on or with measurement axes parallel to a measuring axis ~~(162)~~ oriented perpendicularly to the receiving plane ~~(140)~~;

generating ~~(1020)~~ a further camera image ~~(170)~~ of a further reticle ~~(185)~~ via the afocal optical system ~~(105)~~ in the receiving device ~~(110)~~ from the second side ~~(155)~~ by using a further camera ~~(130)~~, wherein the further light-providing device ~~(125)~~, the afocal optical system ~~(105)~~, and the further camera ~~(130)~~ are arranged coaxially on or with measurement axes parallel to an oblique measuring axis ~~(175)~~ oriented obliquely to the measuring axis ~~(162)~~ and/or the receiving plane ~~(140)~~; and

identifying ~~(1025)~~ or calculating, using the camera image ~~(160)~~ and/or the further camera image ~~(170)~~, the modulation transfer function (MTF) of the afocal optical system ~~(105)~~.