CLAIMS

What is claimed is:

1. A test system for testing digital camera devices, comprising:

a test chart for evaluating optical characteristics of a camera device under test (DUT), the chart comprising a superposition of two or more groups of parallel line pairs, wherein all of the groups of parallel line pairs are oriented at different inclinations; and

a test computer to execute a test program for measuring full field optical performance of the DUT by digitally processing an image of the test chart as captured by the DUT.

2. The test system of claim 1 wherein the groups of parallel line pairs have the same spatial frequency.

3. The test system of claim 1 wherein the line pairs within a group of parallel line pairs have different spatial frequencies.

4. The test system of claim 1 wherein all of the line pairs extend uninterrupted from one edge to another edge of the field of view of an imaging system, containing the DUT, that captures an image of the test chart.

5. The test system of claim 1, wherein the superposition consists of two groups of parallel slanted line pairs with the same spatial frequency, the first group being inclined relative to the line pairs in the second group.

6. The test system of claim 5, wherein the first group of parallel slanted line pairs is perpendicular relative to the second group of parallel line pairs.

7. The test system of claim 1 wherein the line pair frequency is a fraction of the Nyquist frequency of the DUT.

8. A test system for testing digital camera devices, comprising:

a test chart for evaluating optical characteristics of device under test (DUT), the chart comprising a superposition of two or more groups of

sinusoidal gradient of shades, wherein all of the groups of gradients are oriented at different inclinations; and

a test computer to execute a test program for measuring full field optical performance of the DUT by digitally processing an image of the test chart as captured by the DUT.

9. A test system of claim 8 wherein the groups of sinusoidal gradient of shades have the same spatial frequency.

10. A test system of claim 8 wherein the sinusoidal gradient of shades within a group of sinusoidal gradient of shades have different spatial frequencies.

11. The test system of claim 8 wherein all of the line pairs extend from one edge of the field of view of the DUT to another.

12. The test system of claim 8, wherein the superposition consists of two groups of sinusoidal gradient of shades, the first group being inclined relative to the sinusoidal gradient of shades in the second group.

13. The test chart of claim 4, wherein the first group of sinusoidal gradient of shades is perpendicular relative to the second group of sinusoidal gradient of shades.

14. The test system of claim 8 wherein the sinusoidal gradient frequency is based on the Nyquist frequency of the imaging system.

15. A method for creating a test chart comprising:

selecting a line pair spatial frequency; and

superimposing two or more groups of parallel line pairs, wherein all groups of line pairs are oriented at different inclinations.

16. The method of claim 15 wherein the superposition consists of two groups of parallel slanted line pairs having said spatial frequency, the first group being inclined relative to the line pairs in the second group.

17. The method of claim 16 wherein the first group of parallel slanted line pairs is perpendicular relative to the second group of parallel line pairs.

18. The method of claim 15 wherein the line pair spatial frequency is a fraction of the Nyquist frequency of the DUT.

19. A method for evaluating optical characteristics of a device under test (DUT), comprising:

applying spatial convolution to a filter and a digital image of a test chart captured by an imaging system using the DUT, wherein the test chart comprises a superposition of two or more groups of parallel line pairs oriented at different inclinations and all of the line pairs extend from one edge of the field of view of the imaging system to another edge as seen in a full sensor resolution image from the system;

selecting a block size and partitioning essentially the entire spatial extent of the filtered digital image into a plurality of blocks based on the block size;

calculating a measure of the energy in each of a selected group of the blocks of the filtered digital image; and

using the measure of energy in each of the selected blocks to compute a figure of merit relating to an optical characteristic of the DUT.

20. The method of claim 19 wherein the figure of merit is a sharpness score.

21. The method of claim 19 further comprising comparing the figure of merit to a threshold and using a result of the comparison to inform a decision as to whether or not the DUT passes an optical performance test.

22. The method of claim 19 wherein said using the measure of energy in each of the selected blocks to compute a sharpness score comprises normalizing the energy measure.

23. The method of claim 19, further comprising generating a sharpness map for the entire field based on the sharpness score of each of the blocks.

24. The method of claim 19 wherein the superposition consists of two groups of parallel line pairs, the line pairs in the first group being inclined relative to the line pairs in the second group.

25. The method of claim 19, wherein the block size is a multiple of the period of the lines in the digital image.

26. The method of claim 19, wherein the filter is a Laplacian Filter.

27. The method of claim 22, wherein normalization comprises normalizing for local contrast and local brightness.

CLAIMS

What is claimed is:

1. A test system for testing digital camera devices, comprising:

a test chart for evaluating optical characteristics of a camera device under test (DUT), the chart comprising a superposition of two or more groups of parallel line pairs, wherein all of the groups of parallel line pairs are oriented at different inclinations, wherein all of the line pairs extend uninterrupted from one edge to another edge of a field of view of an imaging system, containing the DUT, that captures an image of the test chart, and wherein the superposition consists of a first and a second group of parallel slanted line pairs with a same spatial line pair frequency, the line pairs of the first group being inclined relative to line pairs in the second group; and

a test computer to execute a test program for measuring full field optical performance of the DUT by digitally processing an image of the test chart as captured by the DUT.

2. The test system of claim 1, wherein the first group of parallel slanted line pairs is perpendicular relative to the second group of parallel line pairs.

3. The test system of claim 1 wherein the line pair frequency is a fraction of the Nyquist frequency of the DUT.

4. A test system for testing digital camera devices, comprising:

a test chart for evaluating optical characteristics of device under test (DUT), the chart comprising a superposition of two or more groups of sinusoidal gradient of shades, wherein all of the groups of gradients are oriented at different inclinations, wherein all of the groups of sinusoidal gradient of shades extend from one edge to another edge of a field of view of the DUT, and wherein the superposition consists of a first and a second group of sinusoidal gradient of shades having the same spatial sinusoidal gradient frequency, the sinusoidal gradient of shades of the first group being inclined relative to those of the second group; and

a test computer to execute a test program for measuring full field optical performance of the DUT by digitally processing an image of the test chart as captured by the DUT.

5. The test system of claim 4, wherein the first group of sinusoidal gradient of shades is perpendicular relative to the second group of sinusoidal gradient of shades.

6. The test system of claim 4 wherein the sinusoidal gradient frequency is based on the Nyquist frequency of the imaging system.

7. A method for creating a test chart comprising:

selecting a line pair spatial frequency; and

superimposing two or more groups of parallel line pairs, wherein all of the groups of line pairs are oriented at different inclinations, wherein all of the line pairs extend from one edge to another edge of a field of view of a device under test, and wherein the superposition consists of a first and a second group of parallel slanted line pairs having a same line pair spatial frequency, the line pairs of the first group being inclined relative to line pairs in the second group.

8. The method of claim 7 wherein the first group of parallel slanted line pairs is perpendicular relative to the second group of parallel line pairs.

9. The method of claim 7 wherein the line pair spatial frequency is a fraction of the Nyquist frequency of the DUT.

10. A method for evaluating optical characteristics of a device under test (DUT), comprising:

applying spatial convolution to a filter and a digital image of a test chart captured by an imaging system using the DUT to produce a filter digital image, wherein the test chart comprises a superposition of two or more groups of parallel line pairs oriented at different inclinations and all of the line pairs extend from one edge of the field of view of the imaging system to another edge as seen in a full sensor resolution image from the system;

selecting a block size and partitioning essentially the entire spatial extent of the filtered digital image into a plurality of blocks based on the block size;

calculating a measure of the energy in each of a selected group of the blocks of the filtered digital image; and

using the measure of energy in each of the selected blocks to compute a figure of merit relating to an optical characteristic of the DUT.

11. The method of claim 10 wherein the figure of merit is a sharpness score.

12. The method of claim 10 further comprising comparing the figure of merit to a threshold and using a result of the comparison to inform a decision as to whether or not the DUT passes an optical performance test.

13. The method of claim 10 wherein said using the measure of energy in each of the selected blocks to compute a sharpness score comprises normalizing the energy measure.

14. The method of claim 11, further comprising generating a sharpness map for the field of view based on the sharpness score of each of the blocks.

15. The method of claim 10 wherein the superposition consists of two groups of parallel line pairs, the line pairs in the first group being inclined relative to the line pairs in the second group.

16. The method of claim 10, wherein the block size is a multiple of the period of the lines in the digital image.

17. The method of claim 10, wherein the filter is a Laplacian Filter.

18. The method of claim 13, wherein normalization comprises normalizing for local contrast and local brightness.