CLAIMS

1. A method of metrology target design, the method comprising calculating a Zernike sensitivity of pattern placement errors (PPEs) of at least one device design and of a plurality of metrology target designs, and selecting a best metrology target design according to a value of a cost function derived from the calculated Zernike sensitivities, the cost function quantifying a similarity of the Zernike sensitivity between the at least one device design and the plurality of metrology target designs, wherein at least one of the calculating and the selecting is carried out by at least one computer processor.

2. The method of claim 1, wherein the Zernike sensitivity is calculated with respect to Zernike coefficients Z4 … Z36.

3. The method of claim 2, wherein the Zernike sensitivity is calculated with respect to odd Zernike coefficients only.

4. The method of claim 3, wherein the Zernike sensitivity is calculated only with respect to Zernike coefficients Z8, Z11, Z15, Z20, Z24, Z27, Z31, and Z35.

5. The method of any one of claims 1-4, wherein the cost function comprises a distance metric between the PPE Zernike sensitivity of the at least one device design and the PPE Zernike sensitivity of the plurality of metrology target designs.

6. A metrology module comprising at least one computer processor configured to calculate a Zernike sensitivity of pattern placement errors (PPEs) of at least one device design and of a plurality of metrology target designs, and select a best metrology target design according to a value of a cost function derived from the calculated Zernike sensitivities, the cost function quantifying a similarity of the Zernike sensitivity between the at least one device design and the plurality of metrology target designs.

7. The metrology module of claim 6, wherein the Zernike sensitivity is calculated with respect to Zernike coefficients Z4 … Z36.

8. The metrology module of claim 7, wherein the Zernike sensitivity is calculated with respect to odd Zernike coefficients only.

9. The metrology module of claim 8, wherein the Zernike sensitivity is calculated only with respect to Zernike coefficients Z8, Z11, Z15, Z20, Z24, Z27, Z31, and Z35.

10. The metrology module of any one of claims 6-9, wherein the cost function comprises a distance metric between the PPE Zernike sensitivity of the at least one device design and the PPE Zernike sensitivity of the plurality of metrology target designs.

11. A method of metrology target design, the method comprising:
for each of at least one device design and a plurality of target design candidates:
repeatedly for a plurality of runs:

generating a plurality of N_i (N_i>100) Zernike coefficient values for each of a plurality of Zernike polynomials Z_i, the values generated pseudo-randomly with respect to specified distributions over specified ranges,

calculating PPEs for each of the Zernike polynomials, and

calculating a respective PPE measure for the run; and

deriving a distribution of the calculated respective PPE measures;

correlating each of the derived target design candidate distributions with the at least one derived device design distribution to yield for each target design candidate a device correspondence measure; and

selecting a best metrology target design according to the derived device correspondence measures,

wherein at least one of the generating, the calculating, the deriving, the correlating and the selecting is carried out by at least one computer processor.

12. The method of claim 11, further comprising selecting the target design candidates to represent segmentation alternatives of a specified target design.

13. The method of claim 12, further comprising ranking the segmentation alternatives using the device correspondence measure.

14. The method of claim 11, further comprising carrying out the calculating stages in parallel to a metrology simulation process and integrating a ranking using the device correspondence measure with a ranking derived from the metrology simulation process.

15. The method of claim 11, further comprising carrying out the method for multiple device designs and carrying out the selecting with respect to the device correspondence measures derived for all the device designs.

16. The method of claim 15, wherein the selecting is carried out with respect to a robustness measure, derived from the multiple device correspondence measures.

17. A metrology module comprising at least one computer processor configured to, for each of at least one device design and a plurality of target design candidates:

repeatedly for a plurality of runs:

generate a plurality of N_i (N_i>100) Zernike coefficient values for each of a plurality of Zernike polynomials Z_i, the values generated pseudo-randomly with respect to specified distributions over specified ranges,

calculate PPEs for each of the Zernike polynomials, and

calculate a respective PPE measure for the run; and

derive a distribution of the calculated respective PPE measures;

correlate each of the derived target design candidate distributions with the at least one derived device design distribution to yield for each target design candidate a device correspondence measure; and

select a best metrology target design according to the derived device correspondence measures.

18. The metrology module of claim 17, further configured to select the target design candidates to represent segmentation alternatives of a specified target design.

19. The metrology module of claim 18, further configured to rank the segmentation alternatives using the device correspondence measure.

20. The metrology module of claim 17, further configured to carry out the calculating stages in parallel to a metrology simulation process and to integrate a ranking using the device correspondence measure with a ranking derived from the metrology simulation process.

21. The metrology module of claim 17, further configured to use multiple device designs and select the best target with respect to the device correspondence measures derived for all the device designs.

22. The metrology module of claim 21, further configured to select the best target with respect to a robustness measure, derived from the multiple device correspondence measures.

23. A method of optimizing metrology target design, the method comprising, starting with an initial target design determined according to metrology performance requirements, and using a simulation tool:

comparing a Zernike sensitivity of pattern placement errors (PPEs) between the initial target design and at least one device design, with respect to at least two directions,

estimating a process window for the initial target design, and

deriving an improved metrology target design from the initial target design by modifying the initial target design to increase a correspondence in the Zernike sensitivity and to increase the process window,

wherein at least one of the comparing, the estimating and the deriving is carried out by at least one computer processor.

24. The method of claim 23, wherein the deriving further comprises reiterating the comparing and the estimating for consecutively derived improved target designs.

25. The method of claim 23, wherein the at least two directions comprise a target design direction and a perpendicular direction thereto.

26. The method of claim 25, wherein the at least one device design is tilted with respect to the target design direction.

27. The method of any one of claims 23-25, wherein a pitch of the improved metrology target design is 10-30% larger than a pitch of the at least one device design.

28. A metrology module comprising at least one computer processor configured to, starting with an initial target design determined according to metrology performance requirements, and using a simulation tool:

compare a Zernike sensitivity of pattern placement errors (PPEs) between the initial target design and at least one device design, with respect to at least two directions,

estimate a process window for the initial target design, and

derive an improved metrology target design from the initial target design by modifying the initial target design to increase a correspondence in the Zernike sensitivity and to increase the process window.

29. The metrology module of claim 28, further configured to reiterate the comparing and the estimating for consecutively derived improved target designs.

30. The metrology module of claim 28, wherein the at least two directions comprise a target design direction and a perpendicular direction thereto.

31. The metrology module of claim 30, wherein the at least one device design is tilted with respect to the target design direction.

32. The metrology module of any one of claims 28-31, wherein a pitch of the improved metrology target design is 10-30% larger than a pitch of the at least one device design.