Table 1. Comparison of the optimization performance and efficiency.

Test patterns	Methods	PE (nm)	EPE (nm)	NILS	Runtime (sec)	
					SO	MO
Brick contact array	PB	502	2.66	0.93	110.0	54.9
	ZPB	492	2.49	0.95	2.45	38.6
Regular contact array	PB	484	1.98	1.32	116.4	52.2
	ZPB	496	2.02	1.28	2.34	39.8

ZPB algorithm. In addition, the MO also records a slight speedup with the latter. This is because the TCC can be calculated from the linear equations in Eq. (11) efficiently, while ordinarily it would need multiple integrations.

5. Conclusions

In this paper, we propose an efficient SMO algorithm using the Zernike polynomial functions to represent the source patterns. We demonstrate that the source patterns can be represented with a small number of Zernike polynomials, and the source optimization problem can be formulated as a quadratic problem. We show that this can deliver similar performance to that provided by the pixel-based algorithm in enhancing both the pattern fidelity and robustness; at the same time, the optimization efficiency can be significantly improved due to the smaller number of source variables in source optimization and the use of the linear relationship to calculate the TCC in mask optimization.

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