Dose regularization via filtering and projection: An open-source code for optimization-based proximity-effect-correction for nanoscale lithography

A new method for dose regularization in optimization-based proximity-effect-correction is proposed. In contrast to the commonly adopted approach of adding penalty terms to the objective function, a modified scheme is demonstrated where dose regularization is achieved via filtering and projection techniques. The resulting dose patterns are simple and two-toned, and can thus readily be applied in production. Furthermore, existing extensions developed in the context of topology optimization that build on top of the filtering framework, such as robust optimization and strict length scale control, can be adopted directly. The validity of the scheme is assessed in experiments, where the resolvable feature size of the considered 30 kV electron-beam lithography system is decreased from around 100 nm to a few tens of nm. A Python implementation of the scheme is made freely available.

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