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Fast multi-scale simulations of a Step and Flash Imprint Lithography

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In this talk we present a fast graph grammar-based solvers resulting in 90 percent speedup in multi-scale simulations of the Step and Flash Imprint Lithography (SFIL), a modern patterning process. The multi-scale simulation involves nano-scale Molecular Statics model coupled with macro-scale linear elasticity with thermal expansion coefficient. The simulations involve the densification of the liquid polymer inside the feature resulting from the photopolimerization, as well as shrinkage of the feature after removal of the template. The macro-scale domain is solved with a new version of multi-frontal direct solver with the graph grammar based mechanism for reuse of the sub-domains with similar geometries and similar material properties. The graph grammar model enables for automatic localization of the sub-domain that can be reused in our solver algorithm and -as a result - leads to a 90 percent speedup in computation time.

Keywords: multi-scale, step and flash imprint lithography, finite element method, linear elasticity