Multilayer grating profile optimization for applications in laser systems

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One-dimensional multilayer reflection gratings with different groove shapes (such as binary, triangular, sinusoidal gratings) are considered. The gratings are optimized for maximum diffraction efficiency in the -1 order in Littrow conditions. A rigorous formulation for the design optimization problem based on merit function minimization is presented. Different forms of merit function are considered, with respect to the specifications required for suitable grating applications in laser systems. Nelder-Mead (simplex) method is applied for minimizing the merit function. At each step the direct problem is solved by means of a combination of the incomplete Galerkin's method and the scattering matrix method. The optimization results for multilayer gratings with different groove shapes are compared.