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Optimal coating of laser mirrors for the generation of ultrashort laser pulses. (English)

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Summary: Ultrashort laser pulses play an important role in various scientific and industrial applications. For instance, they allow studying the dynamics in fast molecular processes or improve the power of imaging techniques in medical technology, as in optical coherence tomography.

The generation of such short pulses requires techniques for dispersion compensation over an enormous bandwidth. Therefore laser cavities with so-called double chirped mirrors are used. These mirrors consist of a series of alternating high- and low-index layers. The optical properties of the laser cavity depend on the material, the thickness and the number of the layers. So the generation of ultrashort laser pulses can be formulated as an inverse problem:

How have the mirrors to be coated to design laser cavities with prescribed spectral properties?

Mathematically, the coating of a mirror is described by a space (time) dependent refractive index n . The spectral properties of the mirror are modeled by its complex, frequency dependent reflection coefficient r . Now, the inverse problem reads: given r find n . We suggest to solve the inverse problem relying on its relation to an one-dimensional Schrödinger equation.

MSC:

78A60 Lasers, masers, optical bistability, nonlinear optics

78M25 Numerical methods in optics (MSC2010)

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