THE RCWA METHOD - A CASE STUDY WITH OPEN QUESTIONS AND PERSPECTIVES OF ALGEBRAIC COMPUTATIONS[*]

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Abstract. Diffraction of light on periodic media represents an important problem with numerous physical and engineering applications. The Rigorous Coupled Wave Analysis (RCWA) method assumes a specific form of gratings which enables a straightforward separation of space variables. Using Fourier expansions, the solutions of the resulting systems of ordinary differential equations for the Fourier amplitudes can be written, after truncation, in form of matrix functions, with an elegant formulation of the linear algebraic problem for integrating constants. In this paper, we present a derivation of the RCWA method, formulate open questions which still need to be addressed, and discuss perspectives of efficient solution of the related highly structured linear algebraic problems. A detailed understanding of the RCWA method for the two-dimensional grating is, in our opinion, necessary for the development of a successful generalization of the method to practical problems.

Key words. Diffraction of electromagnetic waves, Maxwell's equations, periodic gratings, RCWA, truncated Fourier expansions, matrix functions, structured matrices, scattering amplitude.

AMS subject classifications. 78A45, 42A20, 42A85, 35Q60, 65L10, 65F10, 65F30.

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