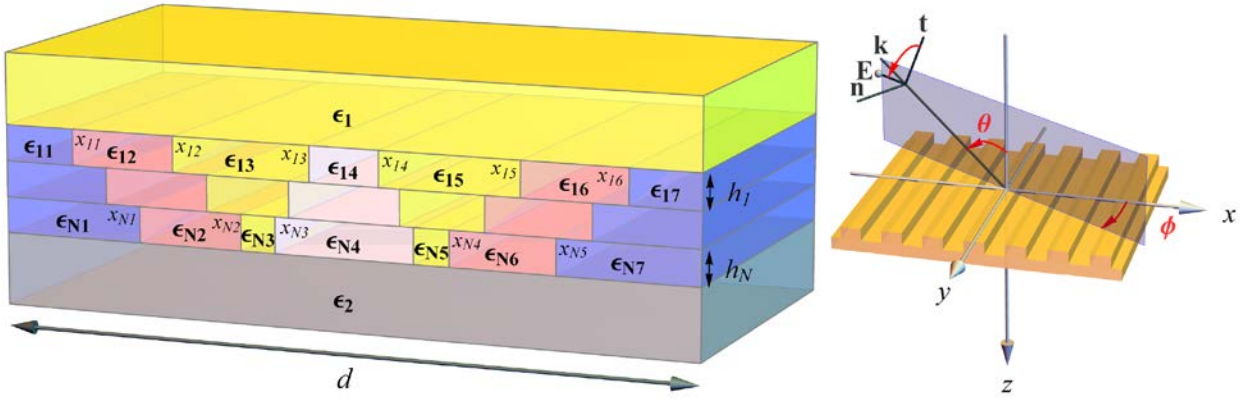
® AiryAnisoRCWA

AiryAnisoRCWA Software Capabilities

Description: Rigorous coupled wave analysis (RCW) of diffraction gratings formed in anisotropic media combined with a polarization ray tracing engine. The incident media, the substrate and the grating materials can be uniaxial, biaxial, optically active or isotropic.

Applications: Diffraction gratings in calcite, LiNbO3 and other anisotropic materials, holographic optical elements, monochromators, etc.

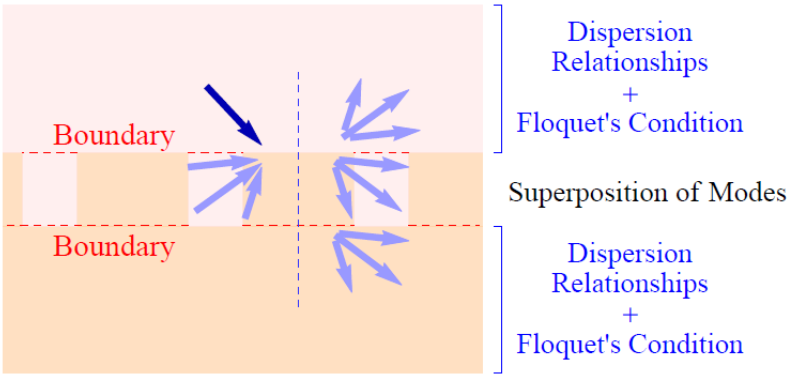
Features: **AiryAnisoRCWA** analyzes arbitrary one dimensional gratings formed from anisotropic or isotropic materials. The **AiryAnisoRCWA** software package is Airy Optics' unique extension to the standard **RCWA** algorithm.



In **RCWA** the grating structures are entered as layers of rectangular regions, each with a dielectric tensor; isotropic materials have constant diagonal matrices. Triangular and curved grating profiles are entered as staircases of many layers. Incident light can be in-plane or out-of-plane with arbitrary azimuth ϕ.

RCWA is widely used for analyzing periodic diffractive structures, such as diffraction gratings, wire grid polarizers, and holograms. RCWA calculates exact solutions for the reflection from and transmission through periodic structures. **AiryAnisoRCWA** is a substantial enhancement

which also models anisotropic grating structures such as gratings in calcite, lithium niobate, sapphire, and other materials. **RCWA** is a straightforward, non-iterative, and deterministic technique which calculates the amplitude coefficients for each diffraction order. The accuracy depends solely on the number of Fourier terms retained in the Floquet-Fourier expansions of the grating structure. The algorithm was initially developed for modeling volume holographic gratings, then extended to surface-relief and multilevel grating structures.



The basic **RCWA** algorithm solves the boundary value problem for forward and backwards propagating waves for all diffraction orders. Each wave interacts with all the components of a three dimensional refractive structure described by its Fourier series. The incident, reflected and transmitted waves are obtained by Floquet's condition and the dispersion relations. The user specifies the number of total modes for the calculation, real and evanescent, and specifies the number of exiting modes to continue in the polarization ray trace.

Ray trace engine capabilities: Sequential and non sequential ray tracing, automated ray multiplying and beam dividing at gratings and beamsplitters. 3-D polarization ray tracing matrices and Mueller matrices at all ray intercepts and accumulated through the system.

Material types and libraries: Refractive index libraries for common crystals (uniaxial, biaxial) and glasses. User defined materials and dispersion equations can be added.

Ray trace parameters: AiryAnisoRCWA calculates amplitude coefficients, phases, diffraction efficiencies and mode fields for each diffraction order. For reflection, refraction, and TIR, **AiryAnisoRCWA** calculates wave vectors, Poynting vectors (ray directions), **E**, **D**, **H** and refractive index for each mode (uniaxial: ordinary and extraordinary; biaxial: high and low index), amplitude coefficients (Fresnel coefficients), ray intercepts and optical path lengths. Automated ray multiplying. Combination of exiting modes into combined wavefronts. User defined criteria to kill rays.

Mathematica: Requires *Mathematica*®. All quantities can be manipulated freely within *Mathematica* for flexible operation. The anisotropic RCWA can be called as a subroutine.

4961 E. Oakmont Dr., Tucson, AZ 85718 303 518 2637 khawkins@airyoptics.com