FIU Engineering & Computing
FLORIDA INTERNATIONAL UNIVERSITY

Electrical & Computer Engineering

NUMERICAL ELLIPSOMETRY: AUTOMATED MODELING IN THE N-K PLANE

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Abstract:

A major challenge for those utilizing ellipsometry is numerical processing of the measured data. Our recent work shows how the transcendental, multivalued equations arising from the physics of reflection from layers can be solved in the n-k plane. This approach applies the mathematics of Complex Analysis to numerically solve the equations rather than merely approximate solutions by least-squares fitting. The work presented here describes n-k methods to automate the modeling process for thin, absorbing films, to measure conductive oxide films, and to solve for films on unknown substrates. It is anticipated that additional methods will be needed for other classes of problems. It is known that for measurements at a single wavelength for three film thicknesses, solutions lie on three "twisted curves" in n-k-d space and that solutions are revealed by the intersection of projections of these curves on the n-k plane. The work here extends the previous successive approximation method to a method which may be easily guided to find solutions within the accuracy of the measured data. The method includes visualization of the solution to provide the researcher with a full understanding of the model. Far fewer data need to be taken than in current practice, in principal two wavelengths are sufficient. No parametric modeling of optical properties is used or needed. Computations are carried out independently at each wavelength.

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