

Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Optical Constants Determined by Genetic Algorithms¹ DAVID Y. SMITH, University of Vermont and Argonne National Laboratory, WILLIAM KARSTENS, Saint Michael's College, SHAHEEN M. MALGHANI, University of Vermont — A recent determination^a of the complex refractive index, $n(\lambda) + i \kappa(\lambda)$, of porous silicon employed a genetic^b algorithm to fit the Fresnel equations to reflectance spectra. The procedure appeared to involve more unknowns than explicit equations available for fitting, an indeterminate problem. However, the index values obtained were reasonable, and predicted the properties of porous-silicon multilayers. We have traced this success to the interpolation formulas used for n and κ in the fitting algorithm. They amount to an implicit optical-constant model with the *de facto* assumption of an analytic complex index that can be approximated by a cubic polynomial. Our analysis suggests the procedure can be improved by explicitly using a more appropriate model, e.g., one that uses wave number as the expansion variable and requires that n and κ be even and odd functions of λ , respectively. ^a V. Torres-Costa, R. J. Martín-Palma, and J. M. Martínez-Duart, *J. Appl. Phys.* **96**, 4197 (2004). ^b D. E. Goldberg, *Genetic Algorithms in Search, Optimization and Machine Learning* (Addison-Wesley, Reading, 1989).

¹Supported by US Department of Energy, Office of Science, Materials Science Division under contract DE-FG02-02ER45964, and Office of Nuclear Physics under contract W-31-109-Eng-38.

David Y. Smith
University of Vermont and Argonne National Laboratory

Date submitted: 22 Dec 2004

Electronic form version 1.4