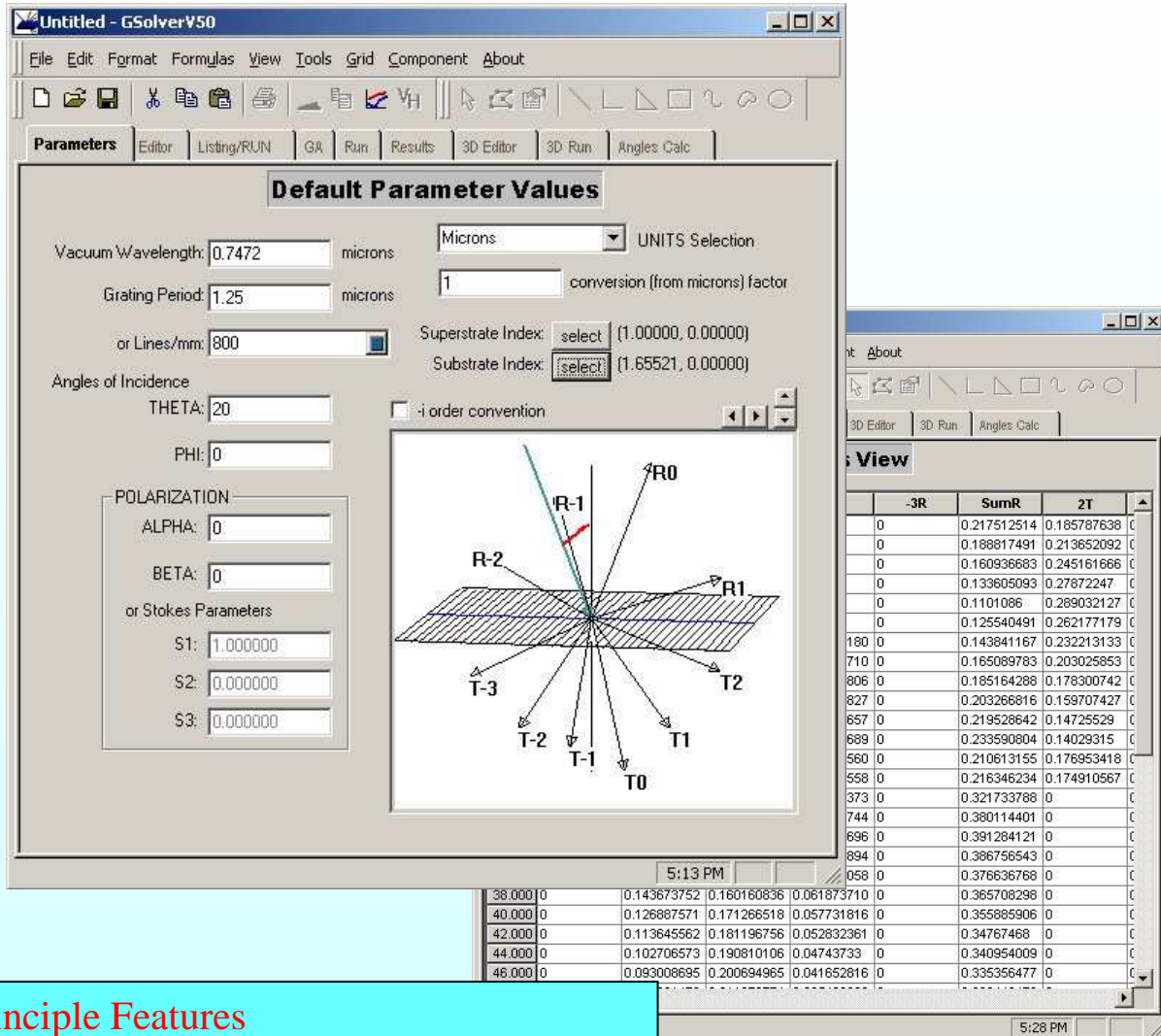


# GSOLVER© V5.1 Diffraction Grating Analysis Program



## Principle Features

- Full 3D vector solution (with choice of solution method)
- Arbitrary polarization including TE, TM, Elliptical
- Conical mounts
- Arbitrary number of index changes per level
- Arbitrary number of grating levels
- Calculation of complex vector E-fields
- Powerful graphical grating structure editor
- Material catalogs and editor
- Optimized partitioned matrix calculations
- Multiple graphical, data spreadsheet, and text windows
- Genetic algorithm based automatic design
- Arbitrary algebraic constraints
- Diffraction angles calculation tool
- Diffracted order phase calculation
- 128 and 256 bit floating point arithmetic

Grating Solver Development  
Company

P.O. Box 353 - Allen, TX 75013  
USA

(972)727-8008 (Voice/FAX)

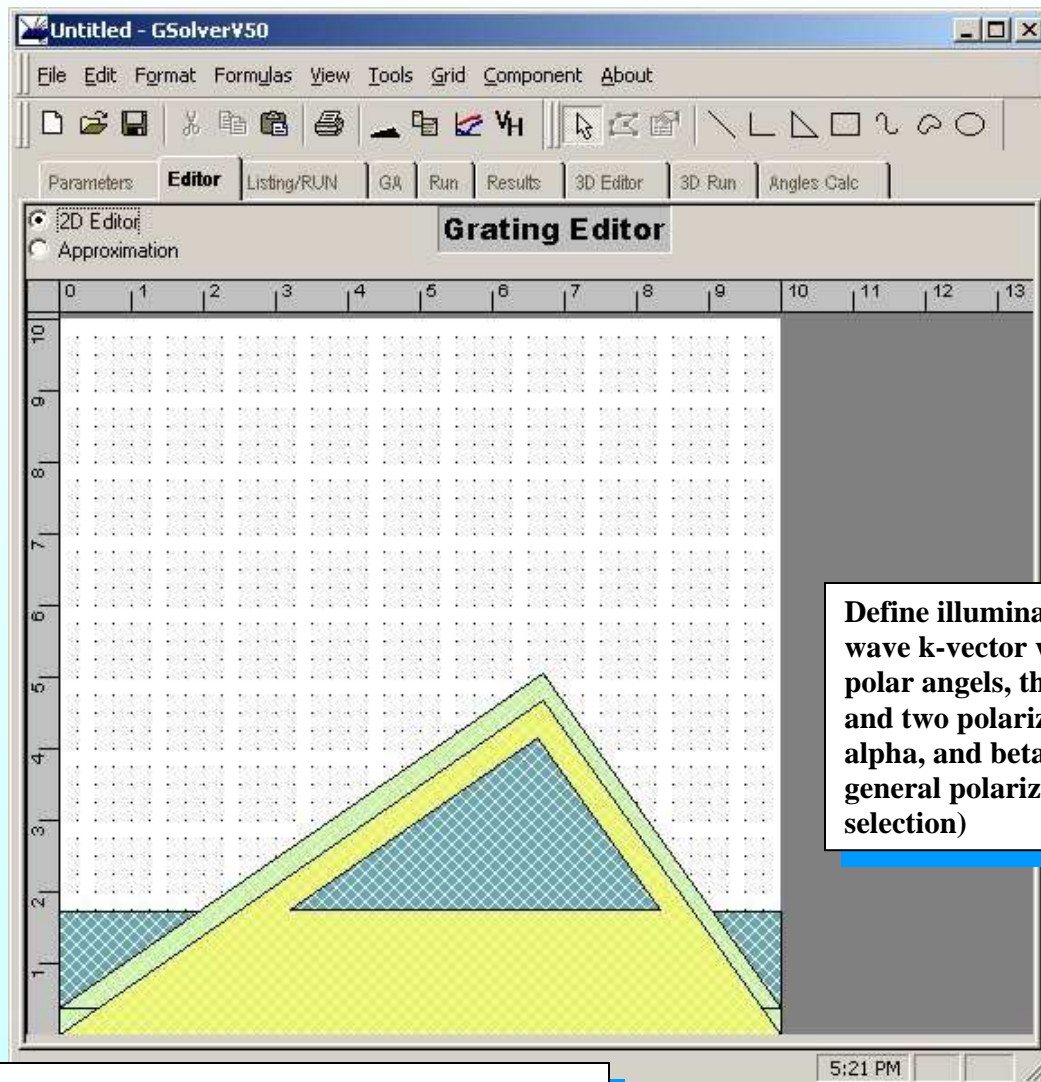
<http://www.gsolver.com>

# GSOLVER© V5.1 Graphical Grating Editor

## Draw arbitrary profiles

- Tools for classical profiles
- Draw structure on unit cell
- Pallet of graphical primitives
- Assign material properties

- Automatic piecewise constant approximation
- Drag and Drop graphical primitives
- OLE container for Microsoft Office products



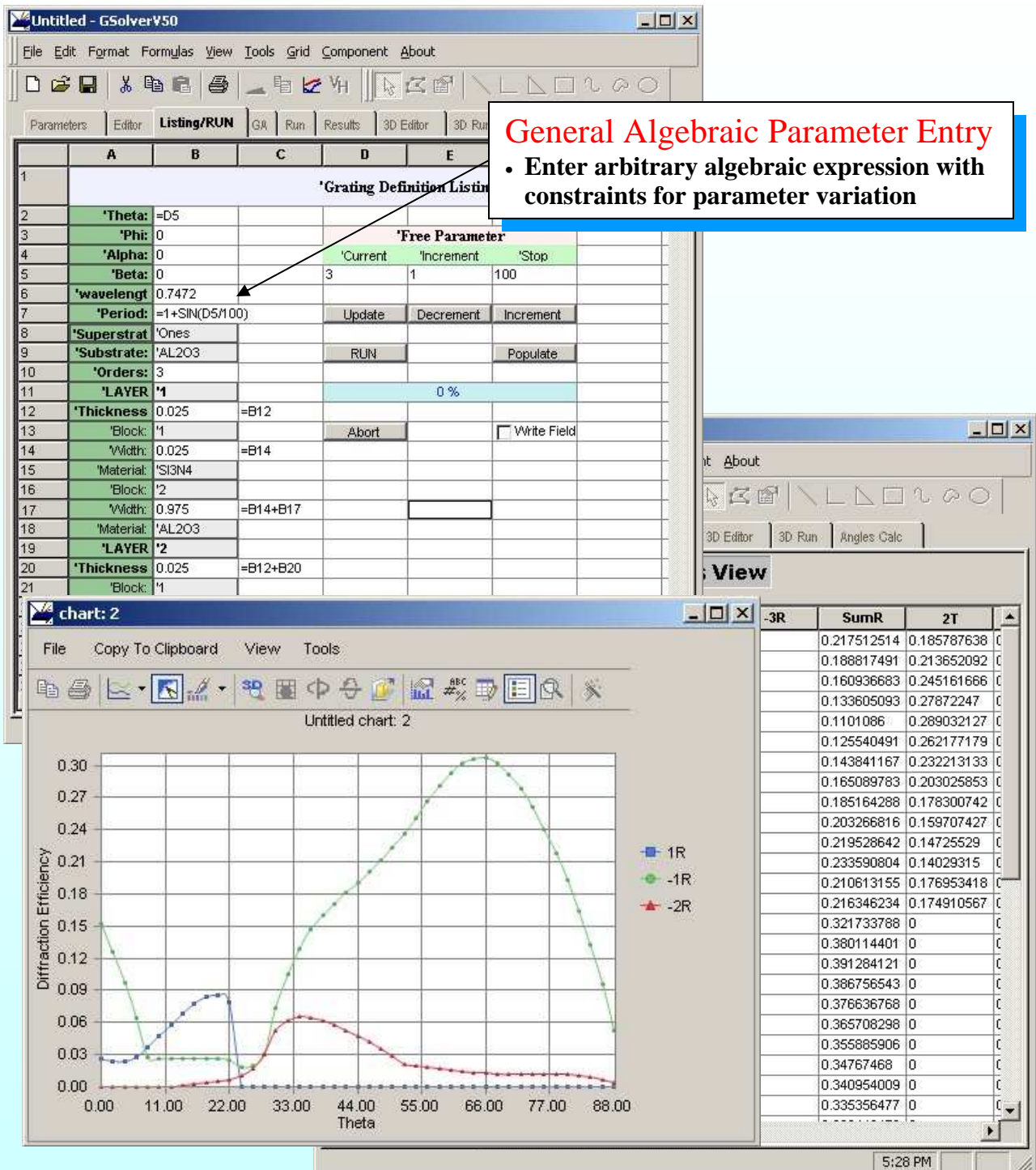
Define illumination, plane wave k-vector with two polar angles, theta, and phi, and two polarization angles, alpha, and beta (this permits general polarization selection)

## Refractive Index Catalog -

- Nobel Metals (Drude Model)
- Glass Catalogs (Schott, Corning, Hoya, O'Hara)
- IR Materials (Sellmeier, Herzberger)
- 9th order polynomial (real and image)
- Table look-up
- Graphical coefficient editor

- Transverse, and crossed grating structures are fully supported
- General polarization, and angle of incidence including conical mounts

# GSOLVER© V5.1 Flexible Execution Control



GSOLVER V5.1 features optimized algorithms that solve the full vector Maxwell equations in the grating region. Arbitrarily complex grating structures made of an arbitrary number of materials specified by piecewise constant model. The algorithm is based on a 'Rigorous Coupled Wave' method using Stack matrix methods to solve for the interlayer boundary conditions. Specializations are used to speed convergence for arbitrary polarization. Optimizations for TE and TM polarization modes are also included.



# GSOLVER© V5.1 Differential Evolution

Untitled - GSolverV50

File Edit Format Formulas View Tools Grid Compo

Parameters Editor Listing/RUN GA Run Results

	A	B	C	
1	GA Grad			
2	Theta:	20		
3	Phi:	0		
4	Alpha:	0		
5	Beta:	0		
6	wavelength	0.7472		
7	Period:	1.25		
8	Superstrat	Ones		
9	Substrate:	AL2O3		
10	Orders:	3		
11	LAYER 1			
12	Thickness	0.025	0.025	
13	Block:	1		
14	Width:	0.025		
15	Material:	Si3N4		
16	Block:	2		
17	Width:	0.975		
18	Material:	AL2O3		
19	LAYER 2			
20	Thickness	0.025	0.05	
21	Block:	1		
22	Width:	0.05		
23	Material:	Si3N4		
24	Block:	2		
25	Width:	0.925		
26	Material:	AL2O3		

Real Parameters

Min Value	Max Value	
0	1.3	0.7119140625
-2.1	124.5	0.1624145508
0	1	0.3136901855

Weight: 0.70000000  
CrossOver: 0.30000000  
Population: 25  
MaxIterations: 25  
Method: Rand1Bin

RUN GA Populate

Abort GA test Options

## Genetic Algorithm Optimization

- Enter arbitrary algebraic constraint expressions
- Arbitrary number of control parameters
- Multiple diffraction efficiency goals
- Multiple evolution strategies
- Full Differential Evolution option control

## Genetic Algorithm Settings/Differential Evolution

Population: 25 nominally 10x total number of parameters

Weight: 0.7 nominally = 0.8 (0 < F <= 1), larger values => faster convergence

Cross-over: 0.3 nominally = 0.9 (0 <= CR <= 1.)

Max Iterations: 25 Stopping criterial

Number of Real Parameters: 3

Goal settings for selected orders:

Order	Goal	Weight
Enter DE Goals: -1 T	.25	1

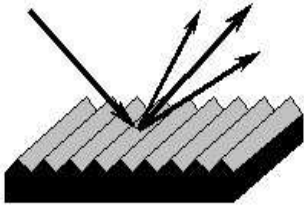
Add Clear Clear All

1R 0.75 1  
-1T 0.25 1

Select differential solution mode

"Rand1Bin"

"Best1Exp"  
"Rand1Exp"  
"RandToBest1Exp"  
"Best2Exp"  
"Rand2Exp"  
"Best1Bin"  
"Rand1Bin"  
"RandToBest1Bin"  
"Best2Bin"  
"Rand2Bin"



## **Grating Solver Development Company**

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[gsolver@gsolver.com](mailto:gsolver@gsolver.com)**

Dear Diffraction Grating Designer,

Thank-you for your interest in GSOLVER. A fully functional demo version of the GSOLVER program is available free. The download site is <http://www.gsolver.com/thanks.htm>.

The demo program does not support file I/O (you cannot save grating structure files or results). It is also limited to a total of ten layers in the piecewise constant approximation. There are several example calculations in the users manual (download from the web site). If you have questions about GSOLVER please FAX, or e-mail them and you will receive a prompt response.

GSOLVER may be used to reproduce numerous rigorous diffraction calculations published in the literature. A few (among many) literature examples are

1. M.G. Moharam, T.K. Gaylord, 'Diffraction analysis of dielectric surface-relief gratings,' JOSA 72, 1385(82).
2. L. Li, 'Multilayer modal method for diffraction gratings of arbitrary profile, depth, and permittivity,' JOSA -A 10, 2581(93).
3. L. Li, C.W. Haggans, 'Convergence of the coupled-wave method for metallic lamellar diffraction gratings,' JOSA-A 10, 1185(93).
4. T.K. Gaylord, W.E. Baird, M.G. Moharam, 'Zero-reflectivity high spatial-frequency rectangular-groove dielectric surface-relief gratings,' Apl. Opt. 25, 4562(86).
5. M.G. Moharam, T.K. Gaylord, 'Rigorous coupled-wave analysis of metallic surface-relief gratings,' JOSA-A 3, 1780(86).
6. T.K. Gaylord, M.G. Moharam, 'Analysis and Application of Optical Diffraction by Gratings,' Proc of the IEEE 73, 894(85).
7. E.G. Loewen, M. Neviere, D. Maystre, 'Grating efficiency theory as it applies to blazed and holographic gratings,' Apl.Opt. 16,2711(77).

See also:

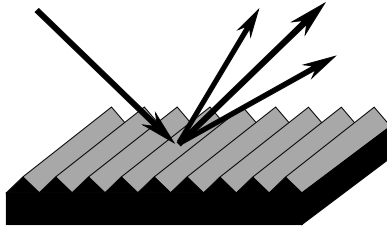
- B.E. Popov, L. Tsonev, D. Maystre, 'Lamellar metallic grating anomalies,' Apl. Opt. 33, 5214 (94).  
T. Glaser, S. Schroter, H. Bartelt, H. Fuchs, E. Kley, 'Diffractive optical isolator made of high-efficiency dielectric gratings only,' Applied Optics, Vol. 41, No. 18/20 June 2002.

S.C. Barden, J.A. Arns, W.S. Colburn, J.B. Williams, 'Volume-Phase Holographic Gratings and the Efficiency of Three Simple VPH Gratings,' Publications of the Astronomical Society of the Pacific, June 2000. (NOAO Preprint No 869)

See IEEE Spectrum June 1998 issue for a review of GSOLVER in 'Software Reviews'.

GSOLVER is based on a full vector implementation of rigorous coupled wave theory. This reduces the solution of (the interlayer) Maxwell equations to an algebraic eigenvalue problem. The intralayer boundary conditions are solved using Stack-matrix methods. Application of the piecewise constant approximation to the grating region permits arbitrary grating structure realization. Calculations are limited by 64bit floating point accumulations of the Intel hardware, and the truncation order parameter.

Sincerely,  
David Fluckiger



## **Grating Solver Development Co.**

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### **Price List for GSOLVER**

#### **GSOLVER V5.1**

**(for Windows OS)**

**\$3295.00**

#### **Shipping and Handling**

**(Domestic or International)**

**\$ 20.00**

**One year subscription for technical  
support and upgrade**

**\$ 300.00**

**GSOLVER V5.1 is a full 32-bit integrated executable for Windows OS. GSOLVER is dongle protected (USB key with single user license).**

**Customers are responsible for any duties and taxes. Texas customers must add applicable state sales tax (8.25%). All orders F.O.B. Allen, Texas, U.S.A.**

**We generally ship within two business days of receipt of Purchase Order.**

**We do not accept credit cards.**

**We are a small business**

**Please supply shipping and billing address and Technical Point of Contact**