G-Deltan V3

An *Interactive* Thermal Analysis Tool

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G-Deltan Contents

G-Deltan Broad Specification

- Compatible with PC using Windows 95+
- Stand alone program
- Ease of use
- Rapid user interaction
- Complex problems
- Simple data transfer

G-Deltan Capabilities

- 500 Nodes
- Linear, radiation and fluid conductors
- User defined constants
- Steady state, transient and combined analysis
- Algebraic definitions of parameters
- Variable properties

G-Deltan Solution Routines

- ***Steady state:*** successive single point iteration with user set over-relaxation (damping) factor
- ***Transient:*** explicit forward difference with automatic reset of time step if required
- Results validated against industry standards

G-Deltan Variables

- ***Power:*** thermostat, cyclic interpolation, update with time
- ***Conductance:*** vs temperature, update with time, natural convection
- ***Capacitance:*** vs temperature, update with time
- ***Limits:*** stop analysis at defined node max/min temperature

G-Deltan Features

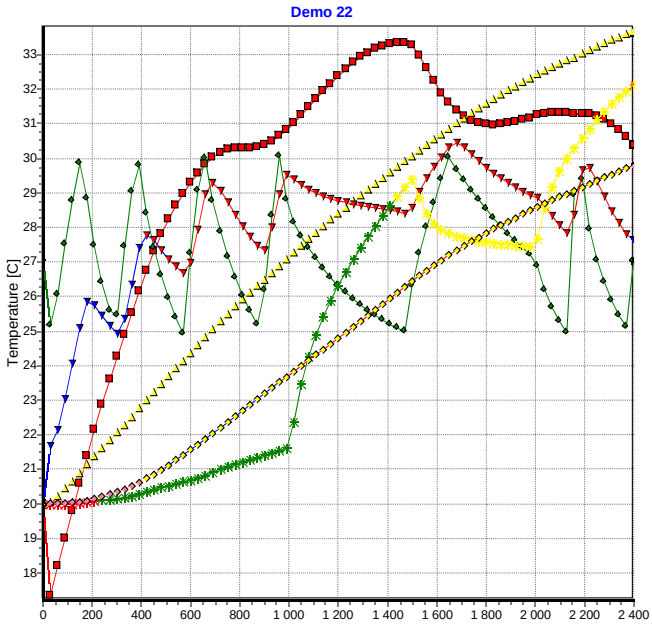
- Word processor style interface
- Familiar syntax
- Model interpreter requires no compilation
- Numerous output formats (T, Q, C, etc.)
- Real time on-screen plotting of transients
- De-bugging and error trapping
- Help files in HTML format

G-Deltan Model Interpreter

- Parses model and loads program arrays
- Free format input
- No limit for expression length
- Predefined variables: Pi
- Operators: + , - , * , / , ^ , div, mod
- Functions: cos, sin, sinh, cosh, tan, arctan, exp, ln, log10, log2, logN, sqrt, sqr, abs, int
- Bracketing to a level of 20

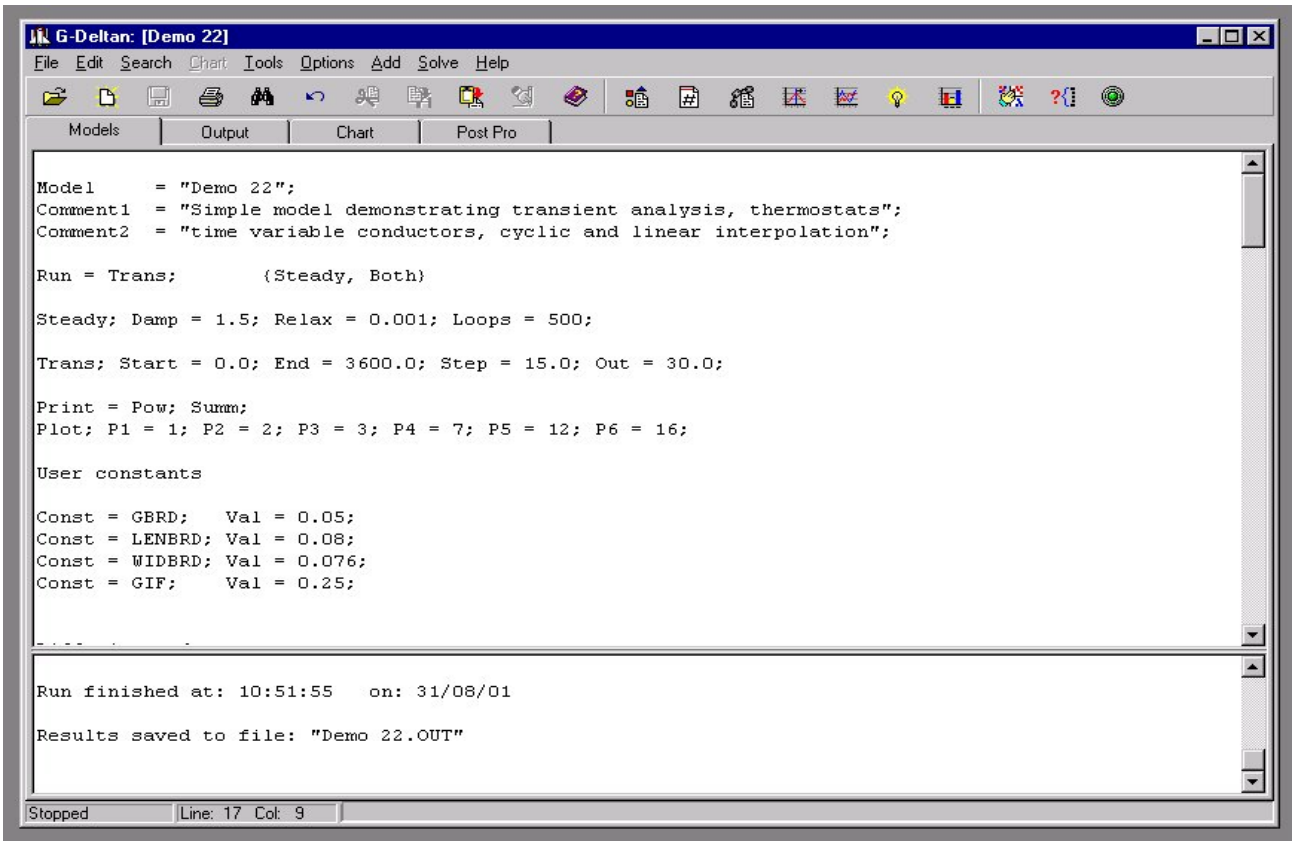
G-Deltan Screen Plot

- Nodes and title loaded from model
- Automatic real time scaling
- Fully editable chart parameters such as line styles and colours
- Zoom feature
- Copy, print and save options (EMF)



G-Deltan User Interface

- Menus for all file, print and edit operations together with run start and help
- Buttons for most common functions
- Blank nodes, conductors, etc. added by a simple click
- Tabbed window for access to model, outputs and chart
- Log window
- Line/column counter for model window
- Progress indicator



G-Deltan Benchmarks

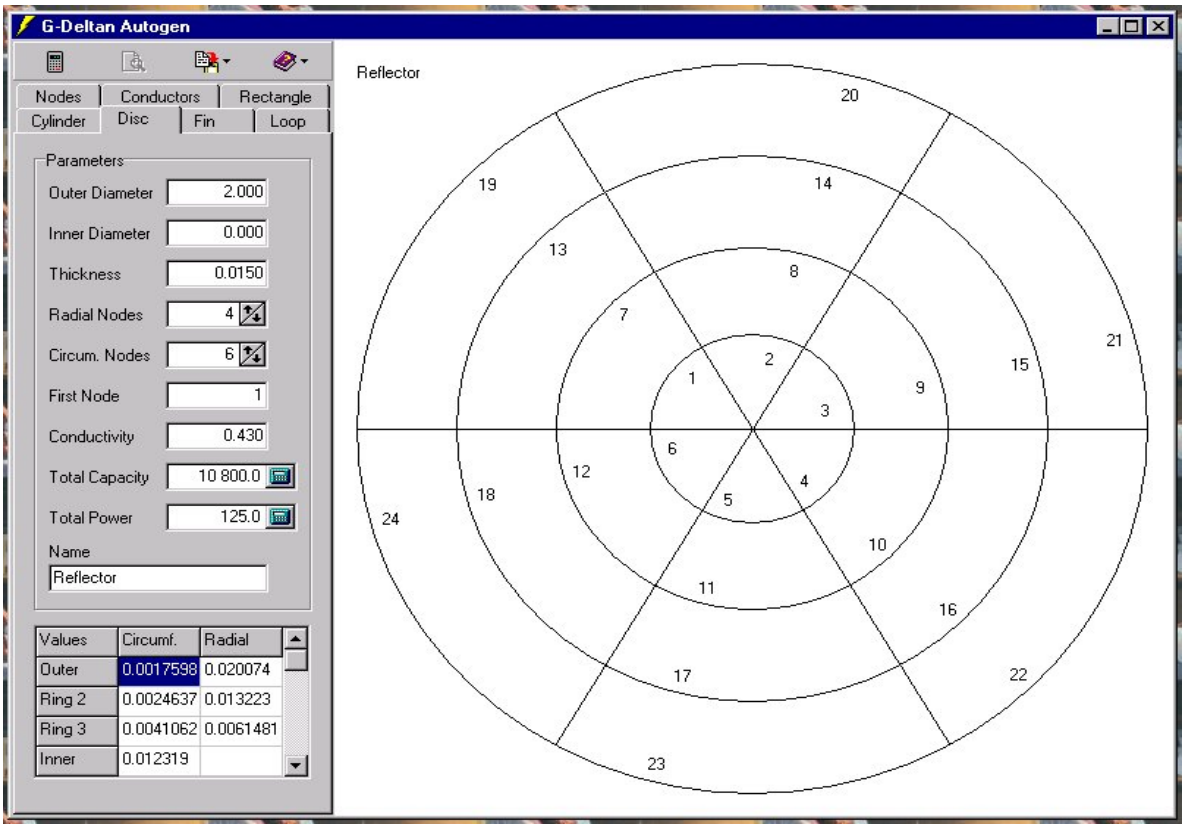
- Favourable performance compared with ESATAN for small to medium sized models

NB: G-Deltan run on a 600 MHz PIII laptop PC. ESATAN was compiled and run on a Sun Ultra 1 workstation. Transient simulation of 24 hours, outputs each 60 s.

Model	Step	G-Deltan	ESATAN
105 node SS	Prepro/parse	<1	8
	Solve	1	14
	Total	1	22
22 node TR	Prepro/parse	<1	2
	Solve	11	19
	Total	12	21
22 node TR + real time plot	Prepro/parse	<1	N/A
	Solve	70	
	Total	71	

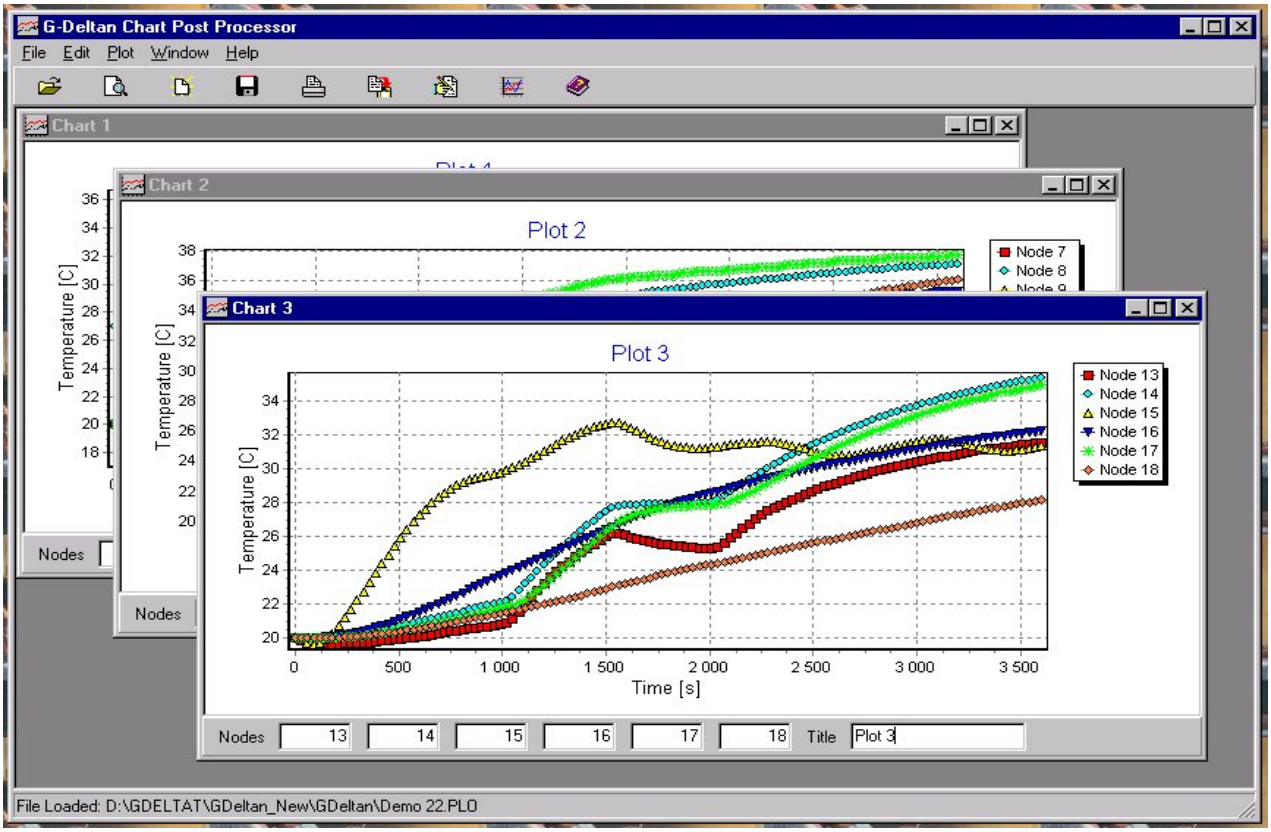
G-Deltan Autogen

- Automatic generation of nodes and conductors and meshing for common shapes (rectangle, cylinder, fin, disc, loop)
- User input of dimensions and material properties
- Visual feedback of meshing
- Copy/Paste data to **G-Deltan**



G-Deltan Postpro

- Generation and printing of multiple charts from transient output file
- Full editing capabilities for line styles and colours
- Automatic scaling
- Zoom feature
- Charts can be copied and pasted into Word documents, etc. for reports
- Charts can be saved as EMF files



G-Deltan Development

- V3 currently in Beta phase
- GUI being refined
- Additional solution algorithms desirable for speed and flexibility
- Further variable routines required
- Users sought for testing and de-bugging

G-Deltan Syntax: Control

- Control of run and outputs
- Examples:

```
Model = "Demo 105"; {Model Filename}
Comment1 = "105 Node model..."; {String <= 70 chars}
Comment2 = "and …..."; {As Comment1}
Run = Steady; {Steady, Trans, Both, Diag for error checking}
Damp = 1.65; Relax = 0.001; Loops = 100; {SS}
Start = 10; End = 3600; Step = 15.0; Out = 60.0; {TR}
Print = Diag; Temp; Tab; CondL; CondR; Pow; Flow; Min; Max;
Tau; Cap; Summ; {Output routines, selectable}
Plot; P1 = 1; P2 = 2; P3 = 3; P4 = 4; P5 = 5; P6 = 6;
{Screenplot, 6 nodes}
```

G-Deltan Syntax: Constants

- **Const = String; Val = Number; Comment** {Comment optional not used by program}
- Examples:

```
Const = PRGPL; Val = 0.9; Percentage coverage
Const = AMBIENT; Val = 12.5;
Const = MASSFL; Val = 10 * 0.15 / 25.4;
```

- Note: Constants must be defined before they are called

G-Deltan Syntax: Nodes

- **Node(I)**{<=500}; **Type = D**{B=Boundary or D=Diffusion};**C:=No**{Capacitance}; **T = No**{Starting temp}; **Q=No**{Power};**Name = String**{<= 30 chars};
- Examples:

```
Node(104); Type = B; T = 20.0; Name = Boundary[104];
Node(105); Type = B; T = 10.0; Name = Boundary[105];
Node(1); Type=D; C=15000; Q=4*8.3; T=20; Name=PCB[1];
Node(2); Type = D; T = AMBIENT + 5; Name = PCB[2];
```

G-Deltan Syntax: Conductors

- **GL(Node i, Node j) = Val;** {GL for Linear conductor, GR for radiation, GF for fluid}
- Examples:

```
GL(1, 2) = 0.1234;
GL(5, 57) = PRGPL * 2.3 / 0.76;
GR(34, 345) = 0.63;
GF(45, 46) = MASSFL * CP;
```

- For GF the upstream node is placed first

G-Deltan Syntax: Variables

- **Examples:**

```
ThStat(2); Ton=25; Toff=30.0; Stat=Off; Q=50.0;

CycliQ(1);Pts=5;Per=800;0;0;240;15;400;20;600;15;800;0;

VariaG(1,21);Type=GL;Pts=4;0;150;50;175;100;200;150;225;

UpdatG(1,21);Type=GL; Time > 1500.0;  New = Old * Pi/2;

Limits(3); Min = 0; Max = 50;

UpdatQ(12); Time > 1000; New = 5;
```