



Ucamco

Former Barco ETS

Smartplate

Innovative Software for Reliable Plating

September 2011

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STOP THE BAD. ACCELERATE THE GOOD.
BLUE COAT YOUR BUSINESS.

Briefing

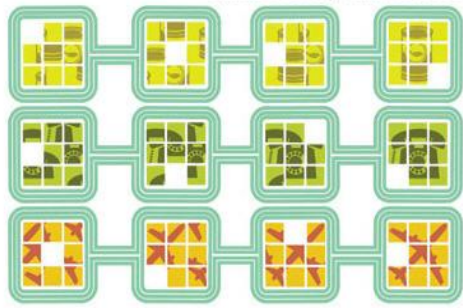
Algorithms

Business by numbers

Sep 13th 2007
From *The Economist* print edition

Consumers and companies increasingly depend on a hidden mathematical world

Illustration by Gillian Blease



ALGORITHMS sound scary, of interest only to dome-headed mathematicians. In fact they have become the instruction manuals of modern life. In fact they have become the instruction manuals of modern life.

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Wikipedia describes the Luhn algorithm. See also Autonomy, Andrew Herbert of Microsoft, Boreas, Jack Antonowicz, Andrew Herbert Luhn algorithm. See also Wikipedia describes the Luhn algorithm.

Plating is a Critical Process



- Essential for board performance
- Strict tolerances
- Closely monitored by customers
- Quote from a PCB manufacturer:

“My customers judge me by my plated holes.”

Plating is Black Magic



- Complex electrochemical process
- Job dependent
 - Copper pattern
 - Hole aspect ratio
- No analytical understanding,
Purely empirical, based on experience
- Unavoidable consequence:
 - Errors
 - Human factor, quality depends on skill of operator

Plating Uncertainty is Costly

A stylized sunburst graphic with a central orange circle and numerous radiating lines of varying lengths, some in orange and some in a lighter yellowish-orange, set against a dark background.

- Cost of scrap
 - Typical scrap rate > 1% due to plating problems
 - Indicated by a customer survey
- Cost of missed deadlines due to rework
- Cost of dissatisfied customers
- Cost of test plating new jobs
- Cost of overplating to guarantee minimum
 - Waste of copper
 - Waste of electricity

The Team *Elsyca* And *Ucamco*



Elsyca

- Delivers electrochemical modeling solutions and services
- Dedicated to electrochemical modeling
- See www.elsyca.com

Ucamco

- Delivers pre-CAM, CAM and viewing software related services
- Dedicated to the PCB industry
- See www.ucamco.com
- The Elsyca-Ucamco team is uniquely capable to provide plating modeling solutions to the PCB industry
- A joint R&D project running 4 years

SmartPlate takes the Guesswork out of Plating



- A model predicts plating thickness
 - Solves the underlying mathematical equations
- It takes into account all relevant parameters
 - Plate line chemistry, temperature and flow rate
 - Anode size and distance
 - Position of jig in tank (distance to bottom, side, and surface)
 - Copper pattern
 - Drill holes aspect ratio
 - Panel position in jig
 - Plating current and time

Modelling accuracy > 85%

The Workflow



The operator selects job and plating parameters on the SmartPlate workstation

- Data send to modeling engine
- The modeling engine calculates thicknesses in background
- Calculated thicknesses are sent back
- On-board and in-hole thicknesses are displayed with the image
 - ✓ Available in CAM
 - ✓ Available in manufacturing and the lab with dedicated viewers

▷ Fully automated

▷ Fully integrated in CAM

Specification: Setting the Plating Parameters

The screenshot displays the SmartPlate software interface, divided into several sections:

- Identification:** Job: 091174-12_scl+1, Top Layer: comp, Bottom Layer: sold.
- Setup:** A table for plating parameters, with a red box highlighting the Pattern Plating section.
- Accuracy:** Coarse and Fine options.
- Top Panel Settings:** Includes checkboxes for Panel and Thieving Bar, and input fields for Clearance and Width.
- Panel Layout:** A 3x3 grid of panels. The center panel is highlighted in red and labeled as the "Target panel".
- Left and Right Panel Settings:** Similar to the top settings, with checkboxes for Panel and Thieving Bar, and input fields for Clearance and Width.
- Bottom Panel Settings:** Similar to the top settings, with checkboxes for Panel and Thieving Bar, and input fields for Clearance and Width.
- Calculate:** A button to calculate the settings.

Red arrows point from the text labels to the corresponding settings in the software interface:

- Panel plating parameters:** Points to the Setup table.
- Pattern plating parameters:** Points to the Pattern Plating section in the Setup table.
- Adjacent panels:** Points to the panels surrounding the target panel in the layout.
- Target panel:** Points to the red-highlighted center panel in the layout.

Calculating: In background

The screenshot displays the SmartPlate software interface. A console window is open, showing the following text:

```
SmartPlate
- Identification
Job: cu5001_panel
Top Layer: cu500101
Bottom Layer: C:\Program Files\EISyCa\SmartPlate\Executables\ConsoleApp\SmartPlateVGG.exe
Setup Re: License smartplate_volume checked out successfully
          This license expires at 31-dec-2009
          Splitter = >1.34218e+008
          Program started with argument list:
Batch Type: volume
Temperature: -1.25
Reading surface mesh from file volume.smesh
0%: 10 20 30 40 50 60 70 80 90 100%
*****
Cathodic C: Surface mesh with 174640 nodes and 175434 faces
          Surface mesh with 171656 unique nodes and 175434 faces
          Splitting hybrid surface grid to triangles - 0.13 s
Cathodic P: Creating initial triangulation
0%: 10 20 30 40 50 60 70 80 90 100%
*****
Pause Time:
Plating Time:
Board Dist:
Bottom Off:
Top Offset: 100.0 mm
Anode Distance: 300.0 mm
Step: 5.0 mm
Calculate
```

The main interface shows a layer stack diagram with the following layers and materials:

- MAS (cu500141)
- SIG (cu500101)
- MIX (cu500102)
- MIX (cu500103)
- PLA (cu500104)
- PLA (cu500105)
- MIX (cu500106)
- MIX (cu500107)
- SIG (cu500132)
- MAS (cu500151)
- cu5001L85
- cu5001L80
- cu500196
- cu500160

A red arrow points from the text "Visual feedback of progress" to the console window, indicating that the progress is visualized through the output text.

Visual feedback
of progress

Visualization: On-board Thickness. Side 1.

The image displays the SmartPlate software interface for job 091174-12_scl+1. The main window shows a green visualization of the PCB thickness on Side 1. A vertical color scale on the right indicates thickness values, with a red arrow pointing to the 'Maximum plating value' at the top and a blue arrow pointing to the 'Minimum plating value' at the bottom. A red arrow also points to the 'Plating scale' in the middle. Below the visualization, a table shows deposit values for various layers:

Layer	Deposit value
comp	35.876
sold	35.555
drill_unpl	
drill	
resin_vias_unpl	
resin_vias	

The 'Plating time' section shows a pattern of 70.0. The 'Display' section includes a checkbox for 'Use plating limits' and fields for 'Minimum plating' (15.0) and 'Maximum plating' (50.0). A red arrow points to the 'Deposit values' table with the text 'Plating values at cursor position'. To the right, a layer stackup window shows the following layers from top to bottom:

- NET
- MAS
- MIX
- SIG
- MIX
- SIG
- SIG
- MIX
- MIX
- MIX
- SIG
- SIG
- MAS
- ROU
- NET
- OUT
- resin_vias
- resin_vias_unpl
- d_15_16
- d_15_16_unpl
- d_11_12
- d_11_12_unpl
- d_7_8_unpl
- d_3_4
- d_3_4_unpl

Red arrows point to the 'Maximum plating value' and 'Minimum plating value' labels, and a blue arrow points to the 'Plating scale' label. A red arrow also points to the 'Deposit values' table.

Visualization: With plating limits. Side 1.

The image shows a screenshot of the SmartPlate software interface. The main window displays a 3D visualization of a PCB with a green plating layer. The interface includes a top menu bar with 'Setup' and 'Results' tabs. Below the menu, there are fields for 'Job: 091174-12_scl+1', 'Top Layer: comp', and 'Bottom Layer: sold'. The 'Setup' tab is active, showing a list of layers: 'comp', 'sold', 'drill_unpl', 'drill', 'resin_vias_unpl', and 'resin_vias'. A scale bar indicates 76.877 μm. A red arrow points from the text 'Plating time' to the 'Plating time' field in the 'Deposit values' section, which is set to 0.0. Another red arrow points from the text 'Plating limits' to the 'Use plating limits' checkbox and the 'Minimum plating' (15.0) and 'Maximum plating' (50.0) fields in the 'Display' section. On the right side, a 'Layers' panel shows a stackup of layers with their respective materials and thicknesses. The stackup includes: NET (091174-12_scl+1_refnett), MAS (resist_c), MIX (comp), SIG (sig_3), MIX (mix_4), SIG (sig_7), SIG (sig_8), MIX (mix_11), MIX (mix_12), MIX (mix_15), SIG (sig_16), MAS (resist_s), ROU (rout), NET (091174-12_scl+1_refnetb), and OUT (profile_panel). Below the stackup, a list of materials is shown: resin_vias, resin_vias_unpl, d_15_16, d_15_16_unpl, d_11_12, d_11_12_unpl, d_7_8, d_7_8_unpl, d_3_4, d_3_4_unpl, drill, and drill_unpl. The bottom of the interface features a color-coded layer selection bar and a 'Display layer in plane 1' button.

SmartPlate

Identification
Job: 091174-12_scl+1
Top Layer: comp
Bottom Layer: sold

Setup Results

comp | sold | drill_unpl | drill | resin_vias_unpl | resin_vias

76.877 μm

0 μm

Deposit values

comp	23.617
sold	22.963
drill_unpl	
drill	
resin_vias_unpl	
resin_vias	

Plating time

Panel: 0.0
Pattern: 70.0

Display

Use plating limits

Minimum plating: 15.0
Maximum plating: 50.0

Plating time

Plating limits

Layers Buildup Subjobs Activate

```
UDUDUDUDUDUD 1 2
RRRRRRRRRRMR
PIPIPIPIPIPI
.....
091174-12_scl+1_refnett
.....
resist_c
.....
comp
.....
sig_3
.....
mix_4
.....
sig_7
.....
sig_8
.....
mix_11
.....
mix_12
.....
mix_15
.....
sig_16
.....
sold
.....
resist_s
.....
rout
.....
091174-12_scl+1_refnetb
.....
profile_panel
.....
resin_vias
.....
resin_vias_unpl
.....
d_15_16
.....
d_15_16_unpl
.....
d_11_12
.....
d_11_12_unpl
.....
d_7_8
.....
d_7_8_unpl
.....
d_3_4
.....
d_3_4_unpl
.....
drill
.....
drill_unpl
```

1 2 3 4 5 0 6 7 8 9 10 11 12 13 14

Display layer in plane 1

Visualization: With corrected plating time.

The image displays the SmartPlate software interface for a PCB plating simulation. The main window shows a top-down view of a PCB with a green plating overlay. A red arrow points from the text 'Plating time' to the 'Plating time' field in the 'Deposit values' section, which is set to 15.476. Another red arrow points from 'Plating limits' to the 'Use plating limits' checkbox and the 'Minimum plating' (15.0) and 'Maximum plating' (50.0) fields in the 'Display' section.

SmartPlate Identification:
Job: 091174-12_scl+1
Top Layer: comp
Bottom Layer: sold

Setup | Results
comp | sold | drill_unpl | drill | resin_vias_unpl | resin_vias

49.421 μm

0 μm

Deposit values:
comp: 16.086
sold: 15.476
drill_unpl: []
drill: []
resin_vias_unpl: []
resin_vias: []

Plating time:
Panel: 0.0
Pattern: 45.0

Display:
 Use plating limits
Minimum plating: 15.0
Maximum plating: 50.0

091174-12_scl+1 Layers:
UDUDUDUDUDUD 1 2
NRNRNRNRNRMR
PIPIPIPIPIPI
091174-12_scl+1_refnett
resist_c
comp
sig_3
mix_4
sig_7
sig_8
mix_11
mix_12
mix_15
sig_16
sold
resist_s
rout
091174-12_scl+1_refnetb
profile_panel
resin_vias
resin_vias_unpl
d_15_16
d_15_16_unpl
d_11_12
d_11_12_unpl
d_7_8
d_7_8_unpl
d_3_4
d_3_4_unpl
drill
drill_unpl

Visualization: In-hole Thickness

The image displays the SmartPlate software interface for a PCB manufacturing job. The main window shows a top-down view of the PCB layout with a color-coded thickness map. A vertical color bar on the right indicates thickness values from 13.399 μm (blue) to 50.91 μm (red). The bottom panel contains deposit values, plating time, and display options.

SmartPlate Identification:
Job: 091174-12_scl+1
Top Layer: comp
Bottom Layer: sold

Setup: comp | sold | drill_unpl | drill | resin_vias_unpl | resin_vias

Deposit values:
comp: 23.515
sold: 23.492
drill_unpl:
drill:
resin_vias_unpl:
resin_vias:

Plating time:
Panel: 0.0
Pattern: 60.0

Display:
 Use plating limits
Minimum plating: 15.0
Maximum plating: 50.0

091174-12_scl+1 Layers:

Layer	Material
NET	091174-12_scl+1_refnett
MAS	resist_c
MIX	comp
SIG	sig_3
MIX	mix_4
SIG	sig_7
SIG	sig_8
MIX	mix_11
MIX	mix_12
MIX	mix_15
SIG	sig_16
SIG	sold
MAS	resist_s
ROU	rout
NET	091174-12_scl+1_refnetb
OUT	profile_panel
	resin_vias
	resin_vias_unpl
	d_15_16
	d_15_16_unpl
	d_11_12
	d_11_12_unpl
	d_7_8
	d_7_8_unpl
	d_3_4
	d_3_4_unpl
	drill
	drill_unpl

SmartPlate works: Results at a Customer



Job ID	Side	Calculated thickness (μm)	Measured thickness (μm)	Accuracy
Job 1	Top	28.5	27.0	94.74%
	Bottom	25.4	23.0	90.55%
Job 2	Top	39.3	44.0	88.04%
	Bottom	48.5	48.0	98.97%
Job 3	Top	39.0	44.0	87.18%
	Bottom	37.3	42.0	87.40%
Job 4	Top	47.9	46.0	96.03%
	Bottom	41.6	44.0	94.23%
Job 5	Top	34.3	30.0	87.46%
	Bottom	34.1	30.0	87.98%

Features/Benefits



- Calculates plating at CAM time, within 15%
- ✓ Correct errors before they happen
- ✓ No sample boards needed
- ✓ Consistent quality, independent of operator
- ✓ Increase plating knowledge in CAM
- Select critical holes in CAM and visualize these on screen in production and lab
- ✓ The true critical holes are monitored
- Calculate plating in coupon and on board
- ✓ The relation between coupon holes and real holes is then known, not guessed

SmartPlate

An attractive proposal



Configuration



- SmartPlate modeling engine
 - ✓ Performs the calculation
 - ✓ One (1) floating license
- SmartPlate Full
 - ✓ Allows to
 - Specify job parameters
 - Submit job
 - Visualize results
 - ✓ One (1) license to a SmartPlate Full seat
 - Ucam users can replace the seat by (1) floating license to this functionality at the same cost
- SmartPlate View
 - ✓ Allows to visualize job and plating
 - ✓ Three (3) licenses

Software Is Paid Out Of Cost Savings



- Investment capability is limited
- Investment in cost savings compete with investments in capability
- Proposal to eliminate the investment bottleneck
 - Rental per quarter
 - Rental fee 4,950 € per quarter
 - Payment *after* the quarter
 - No financing, pay out of cost savings
 - Automatically prolonged until cancelled
 - Cancellation up to one month before the end of the period

Earn the money before you spend it!

Next Step



- Interested?
 - But maybe skeptical it really works...
- Contact a Ucamco business partner.
 - See www.ucamco.com
- We will with pleasure organize a benchmark to know if it really works for you
- Don't wait! Every day money is wasted...



Ucamco

Former Barco ETS

Genesis



- I have a Genesis system
 - And I do not want to change CAM systems
- No problem
 - SmartPlate works on ODB++ as well as DPF
- Workflow
 - SmartPlate Full
 - Reads ODB++ job
 - Submits job to SmartPlate Modeling Engine
 - Visualizes plating date
 - SmartPlate View
 - Visualizes plating data

Currently Supported Chemistry



- ▷ Rohm&Haas: Intervia 8510
- ▷ Rohm&Haas: Copper Gleam RG 10 High Speed
- ▷ Rohm&Haas: Electroposit 1300
- ▷ McDermid: HiSpec3
- ▷ Atotech: Cupracid TP
- ▷ Generic Electrolyte: specify conductivity