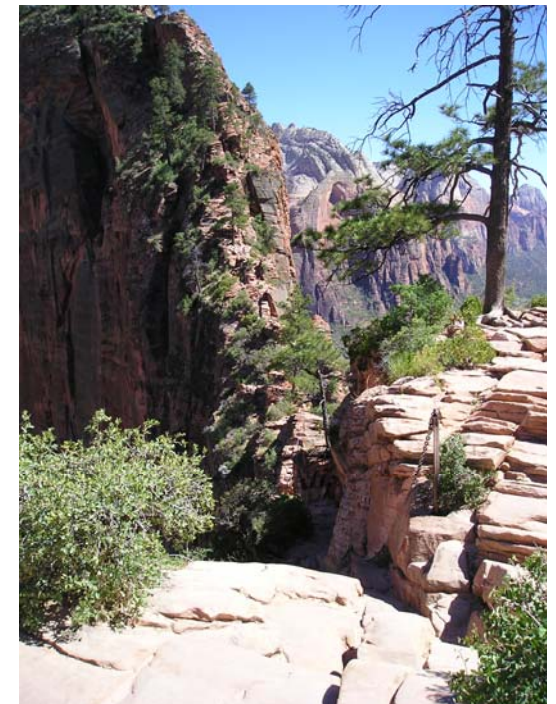


EDA USAGE IN RELIABILITY ASPECTS OF GREEN TECHNOLOGY

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CORE PROPOSITION

- The same analysis software so successfully established in electronic design practice can serve just as well in addressing **GREEN** issues through the product lifecycle (PLC).



OVERVIEW

- CONTEXT
- LANDSCAPE
- THREE TOPIC AREAS FOR EDA
- OPPORTUNITY
- EDA AS SOLUTION ENABLER
- STRAIGHTFORWARD RECIPE
- SOME CASES



CONTEXT

HOW DOES RELIABILITY FIT INTO A GREEN WORLD?

- One Planet to share
- Legacy tradition of EDA in unofficial, yet practical verdant settings:
 - lowering energy consumption
 - Thermal management
 - portable-device battery-limited usage
- Application extensions of COTS products
- ex-post-facto regulatory requirements

LANDSCAPE

- Increasing pervasiveness of Green / Clean needs
- Partial documentation, from different traditions
- Circuits with obscure critical parameters
 - “secret sauce” ...
- Variable design pedigrees and continuity
 - layoffs, H1-B departures, offshore design houses...
- design evolution over revisions
- cumulative BOM-change impact
- Waivers, deviations, or informal “understandings”



3+ CANDIDATES FOR EDA

- Conversion of existing circuitry to emphasize or improve energy-consumption performance;
- Modification of production designs to meet RoHS and other material issues;
- Development of ongoing engineering practices to formalize Green features to a level parallel with established customer "-ility" expectations (reliability, quality, availability, maintainability).
- ++ new instruments and complexities; parameters TBD

Opportunity

- GREEN and CLEAN – TECH areas did not emerge from a quantitative tradition of crisp, systematic execution
- The astute and resourceful will get to define the parameters that count, based on their personal competency profiles,
- Their skills quivers then define the span of options
- Bringing new tools to bear, or using existing tools in new ways, are two paths to expanding these skill sets
- Wider EDA usage is such a force multiplier

circuitry

- Conversion of existing circuitry to emphasize or improve energy-consumption performance;
- Development of new circuit concepts to implement GREEN measurement and control systems
- Adaptations of existing circuits from other areas
- Upgrading one-off academic instrumentation prototypes of promise into wider usage
- Simulations of complex scenarios to "Monte Carlo" novel instrument concepts

RoHS, other material issues

- Modification of production designs to meet RoHS or other material issues
- regulation on chemical and material properties used in fabricated goods;
- any compound or element likely to dissolve in a landfill and migrate into groundwater is eventually likely to be detected and its introduction source brought under some form of regulation.
- Recall fluorocarbons, airborne sulfur, MTBE

RoHS, other material issues

- retroactive liabilities (\$\$) to enterprises identified as users, e.g. asbestos;
- epoxy boards, conformal coatings, and traces of fabrication chemicals all look like targets for litigation and detailed regulation.
- Technical surveys for “unintended consequence” syndromes all lie between desultory and absent
- **POSITIVE!** – new materials of promise need quantitative champions to advance appreciation of their properties and competitive superiorities

EDA AS SOLUTION ENABLER

- Virtually every circuit in use was designed using EDA (Electronic Design Automation), and the core of EDA is the circuit analysis software.
- Some electrical analysis families include:
 - SPICE family for analog or general designs
 - S-parameter modeling for RF design cases
 - Simulation/timing analyses for IC or ASICs
- Associated design files are generally preserved, or can be generated from schematics, and validated against design specifications.

EDA AS SOLUTION ENABLER

Focusing on SPICE (Simulation Program with Integrated Circuit Emphasis):

- for many parts, vendors provide SPICE parameters
- many designs are ports of IC vendor app-note subcircuits, with passive part values directly copied in
- IC vendors provide SPICE-modeled applications, allowing customer-chosen performance levels (e.g. gain, current)
- this enjoy standard usage among design engineers
- It provides accidental but useful homogeneity to designs, allowing systematic, continued PLC usage of design files

EDA AS SOLUTION ENABLER

- use of EDA modeling brings improvement over “visual-scan” reviews for unintended side-effects from design-changes beyond the desired impact
- sometimes imported app-notes have hidden or undocumented features specific to the vendor’s part: before-after-modeling surfaces these items
- for every graph included in a vendor’s data sheet, a cursory consideration of the impact of the variables shown on a user’s circuit is warranted: EDA modeling allows this to proceed beyond qualitative guesswork

STRAIGHTFORWARD RECIPE

For virtually every EDA package in design use, there are compatible versions to support PLC uses

Recommended flow is:

- **Identify proposed change(s) or identified issues**
- **scope reviews and analyses to be revised**
- **Generate or acquire/resurrect suitable EDA model**
- **Characterize before/after by several simulation runs to elucidate significant features, or bring them out if the documentation package is "inadequate"**
- **Act on data, iterate as indicated**

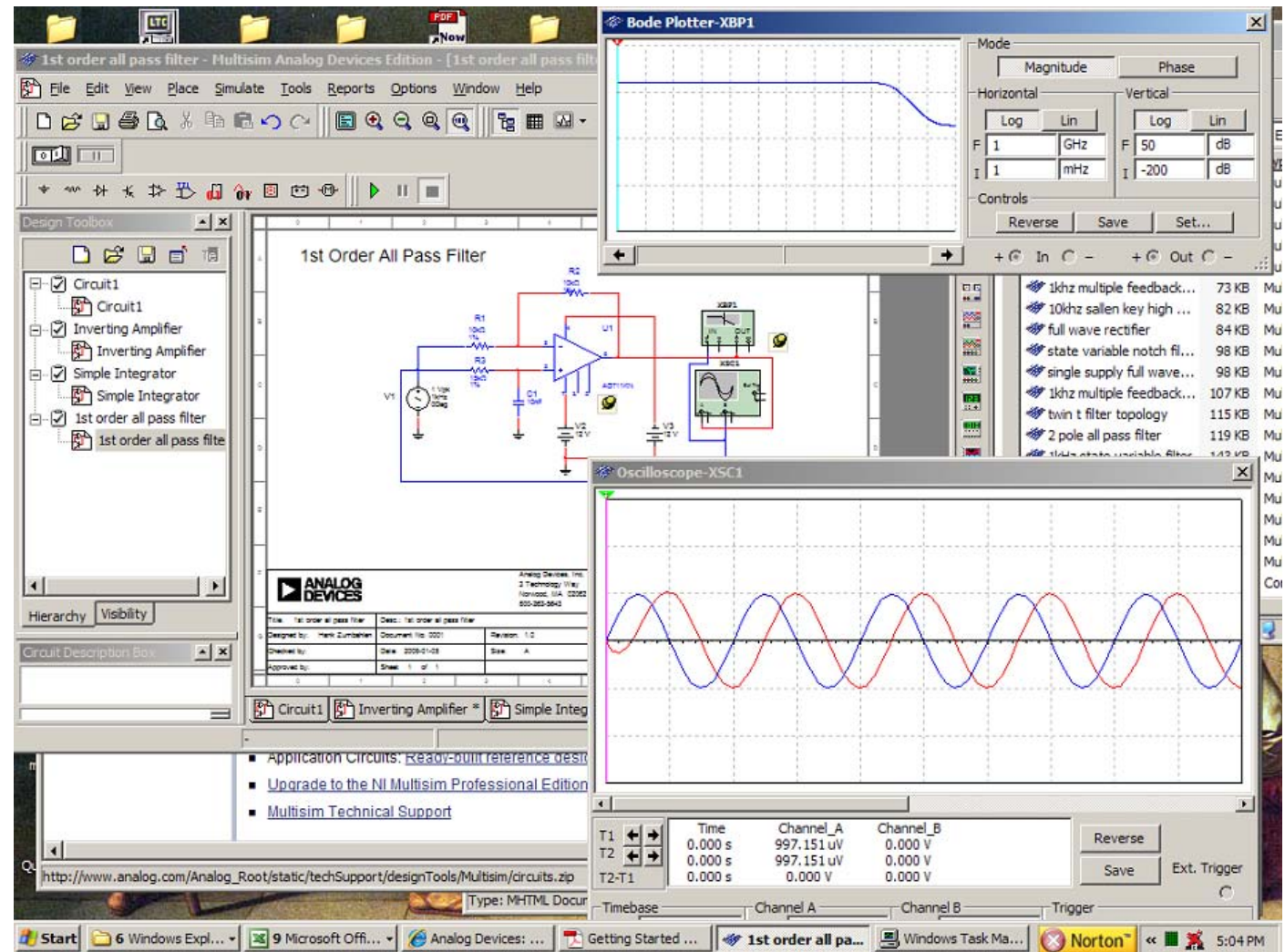
Life can be easier if you can stage a rehearsal to wring out your in-house "local color".

SPICE-SPECIFIC APPROACH

- Linear Technology offers SwCAD III for download FREE. Play with it – the price is right!
- PSPICE, MULTISIM (NI/ADI), AIMSPICE, 5SPICE and others provide node- or component-limited “student” versions, or time-constrained evaluations.
- The best choice is the one that most closely matches your design engineering group’s development package.
- Unless EXTENSIVE changes are involved, any SPICE flavor will do fine. Simulating performance is the point.
- The key is ability to interactively modify schematics as desired, or to edit circuit-descriptive netlists.

AN EXAMPLE

MultiSim
 (NI / ADI)
 All-pass
 filter



SOME CASES THAT ARISE

EDA-accessible steady-state issues to look at:

- **variation of gain settings in signal-conditioning amps from resistor tolerances**
- **increases in duty-cycle or loss of “dead-time” bands**
- **changes in average power dissipation**

EDA-accessible dynamics to consider:

- **changes in transient response, circuit stability, EMI**
- **compromises in performance windows**
- **...more...dependent on circuit specifics under study**

institute Green practices

- Development of ongoing engineering practices to institute or upgrade Green features to a level parallel with established customer "-ility" expectations.
- Reliability is the main area of technical cognizance that has a tradition of system-level technical thinking
- Reliability organizations are used to encountering external "surprises", and dealing with them in stride.

instituting Green practices

requires reliability-style perspective, and a feel for the pragmatics within firms.

- the promise to be interesting, maybe even fun to do, and should be seen as an opportunity for talented professionals
- finally we get use of a broader span of the technical courses taken in school.

instituting Green practices

For firms interested in effective ROI, it is far better to be doing these things than letting them drift, or letting competitors set the parameters

- it becomes a table-stakes issue for firms to be taken seriously by their customers.
- The institutionalization of GREENING is already developing a family of expectations that will mature into standards.
- Get on board now!

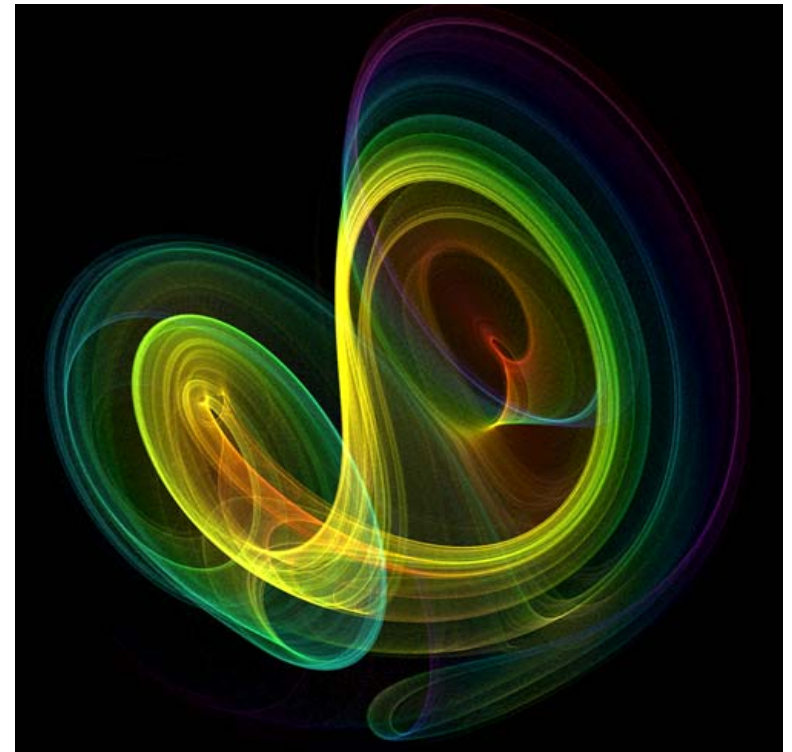
instituting Green practices

EDA is just a beginning! A first-step into quantitative upgrading of the whole sector.

- Recall that CHAOS, the theory of dynamical systems, (re)emerged from Konrad Lorenz's '60s-era meteorology work, which is a cornerstone of the Green technology universe
- Complex-system simulation is a necessary step to dealing with challenging issues without an unending gauntlet of unintended consequences

KEY TAKEAWAY –

- Analytic software simulation established in electronic design can serve just as well in addressing **GREEN** issues during product lifecycles (PLCs). It can blaze a trail into deeper, quantitative areas worth exploring!



Remember -

The future belongs to people who see possibilities before they become obvious.

- Ted Levitt



QUESTIONS?

- OALC,
- Mike,
- and Bryan
- ...
- thank you.

