



Reliability Engineering Services
HALT and Classical Techniques
"Reliability Integration" SM

TIMELY RESOLUTION TO PARTS OBSOLESCENCE/SUBSTITUTION USING EDA

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CORE PROPOSITION

- The same analysis software so successfully established in electronic design practice can also serve well during the rest of the product lifecycle (PLC).



OVERVIEW

- CONTEXT
- LANDSCAPE
- CHALLENGES
- EDA AS SOLUTION ENABLER
- STRAIGHTFORWARD RECIPE
- SOME CASES



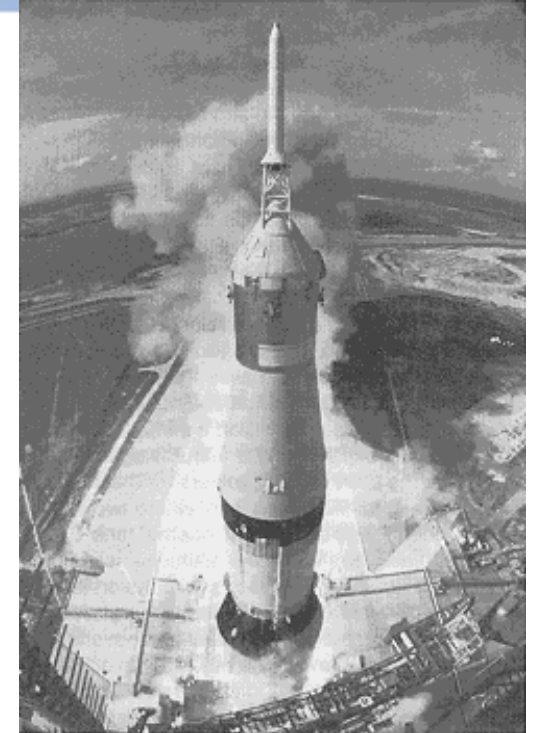
CONTEXT

Why change or evaluate parts in matured programs?

- Manufacturer discontinuation or process change
- Legacy revival, of discontinued items
- Shortages or delays in procurement
- GIDEP-alert events
- suitability assessments of COTS for military or space environmental use
- “retro-qualification” of COTS products
- ex-post-facto agency requirements
- Field failure outbreak or drift to unacceptable levels
- ...more...(see your own organization’s experiences)

LANDSCAPE

- Missing expertise
- Partial documentation
- “secret sauce”
- Obscure critical parameters
- “Signature-block recognition test”
 - layoffs, H1-B departures...
- design evolution over revisions
- prior BOM changes introduce tighter-spec or shifted-window parts
- program-specific waivers or deviations, or informal “understandings”



CHALLENGES

- Organization has a problem to deal with in a randomly occurring, incomplete-information context,
- Those most astute and resourceful get an “extra helping” on their plate, based on their competency to “juggle-in” the added item,
- Their skills quivers then define the span of options brought to bear
- Bringing new tools to bear, or using existing tools in new ways, are two paths to expanding these skill sets
- The situation can come down to large-bet calls:
 1. make case why redesign is not necessary,
 2. new design from scratch,
 3. disqualification of approach, possibly iterated until a good one emerges

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.
- Commonly used electrical analysis families include:
 - SPICE family for analog or general designs
 - S-parameter modeling for RF design cases
 - Simulation/timing analyses for IC or ASIC designs or concepts
- Associated design files are commonly preserved; if not, they can be re-created or 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 are providing SPICE parameters
- many existing designs are ports of IC vendor app-note subcircuits, with passive part values directly copied in
- most IC vendors now provide entire SPICE-modeled representative applications of their parts, allowing customization of the design to customer-chosen performance features (e.g. gain, current capacity and voltage supply levels and ranges)
- this is almost NEVER noted in design packages, being taken as standard practice by design engineers

EDA AS SOLUTION ENABLER

- use of ANY EDA modeling can bring improvement over “visual-scan” reviews of part-change impact
- sometimes the imported app-note approach leaves or includes hidden assumptions or undocumented features particular to the originating vendor’s part: before-after-modeling may surface these items
- for every graph included in a vendor’s data sheet, at least 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
- Potential impact on compliance matrix items, such as WCAs, FMEAs, EMI criteria, and routine derating, can all be dealt with in a quantitative manner

STRAIGHTFORWARD RECIPE

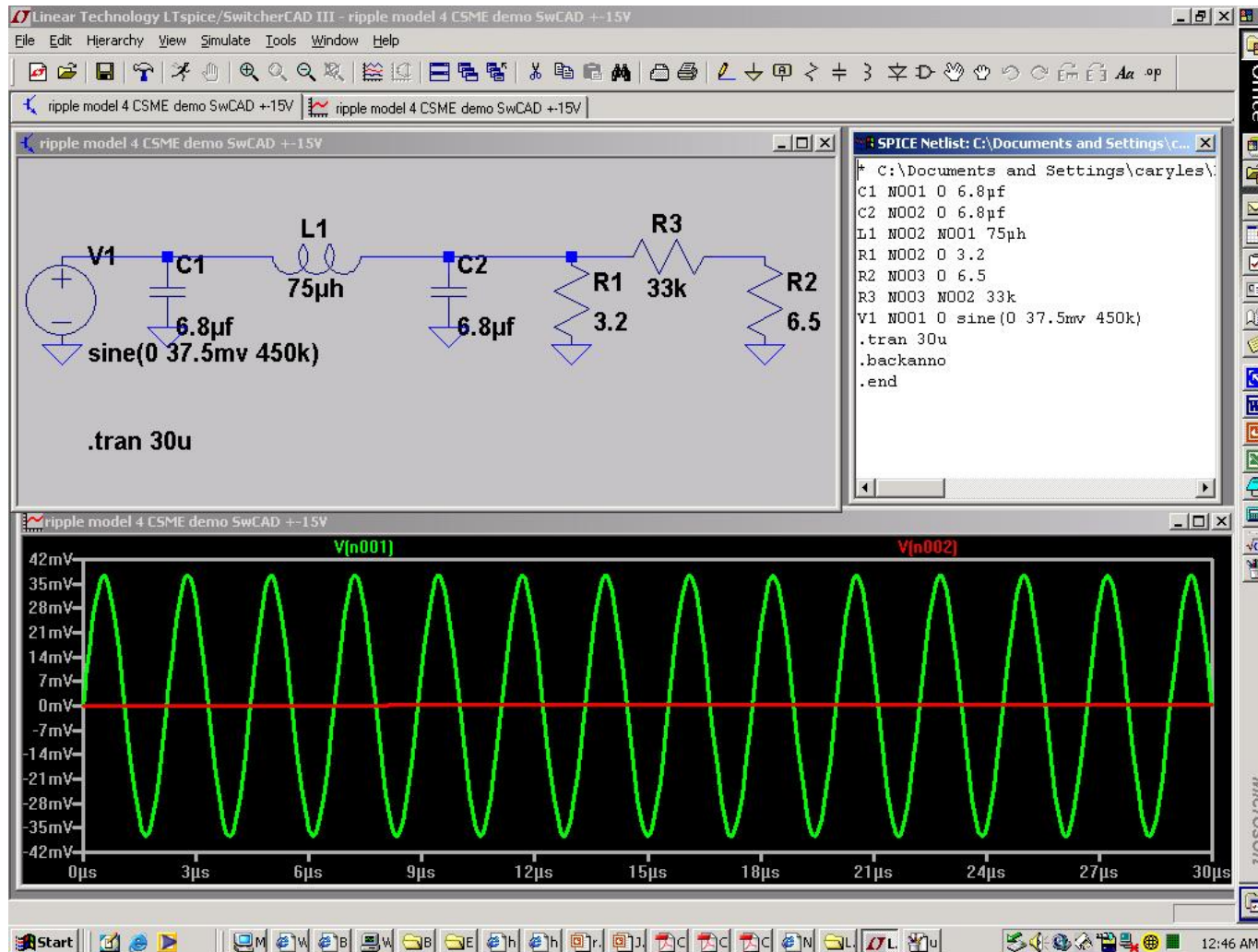
For virtually every EDA package in design use, there are compatible versions to support PLC uses

Recommended flow is:

- Identify proposed change(s) or identified issues
- Determine scope of 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" in some respects
- Act on data, iterate as indicated

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

EXAMPLE – SwCAD ripple filter



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 many other firms 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. (Or, see if you can get an extra seat with them).
- Unless EXTENSIVE changes are involved, any SPICE flavor will do fine. Simulating changes is the point.
- The key is ability to modify parts on an interactive schematic, or to edit circuit-descriptive netlists.

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
- ability to include updated radiation data (e.g. beta droop) or aging effects, if needed
- Possible changes in FMEA propagation

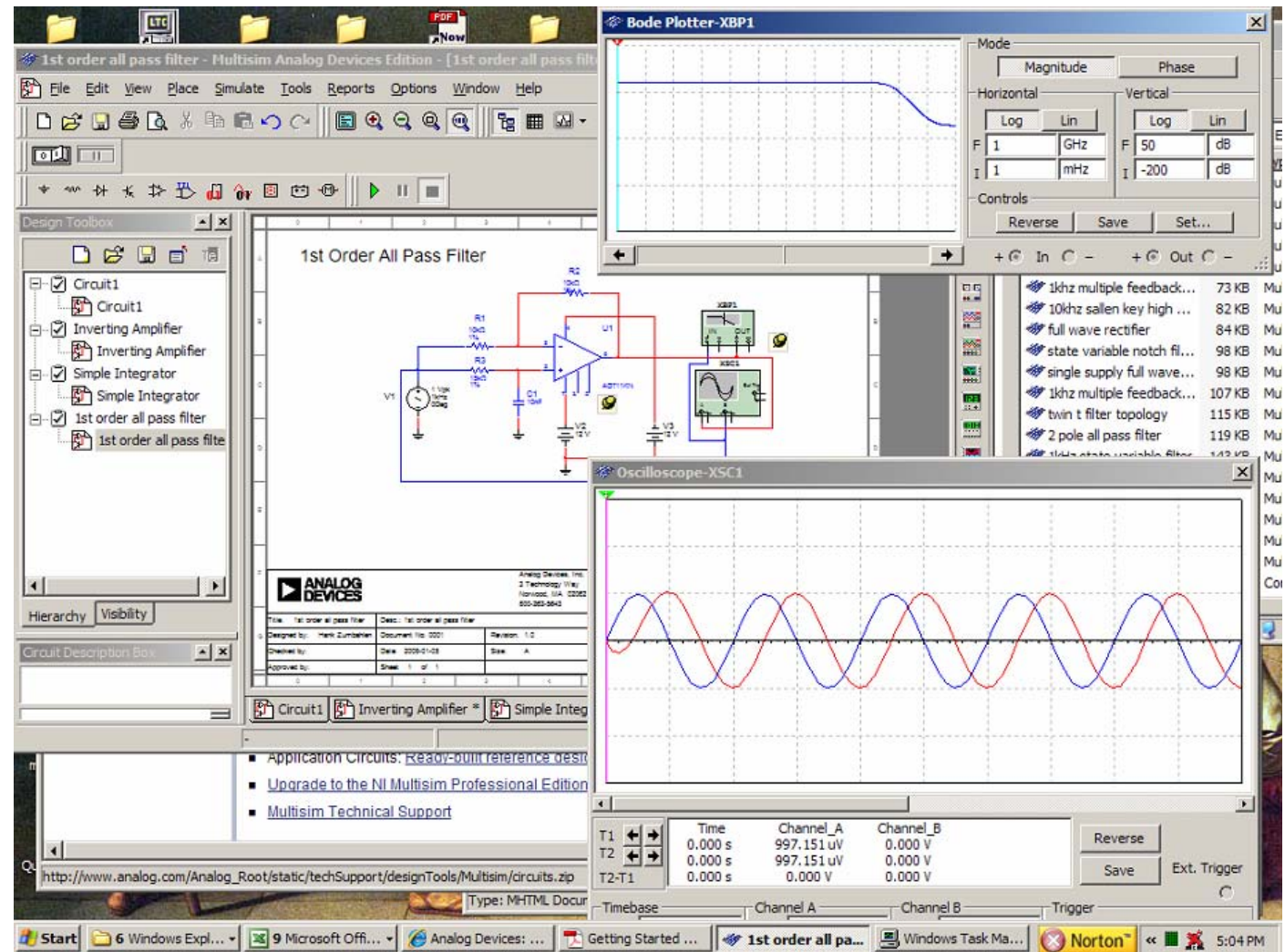
SOME CASES THAT ARISE

EDA-accessible dynamics to consider:

- impact of capacitor ESR changes on startup transients in switching regulators
- changes in transient response, circuit stability, or EMI issues
- compromises in performance windows, derating or EOL margins
- ...more...dependent on specifics of circuit under study

ANOTHER EXAMPLE

MultiSim
 (NI / ADI)
 All-pass
 filter



KEY TAKEAWAY –

- The same analysis software so successfully established in electronic design practice can also serve well during the rest of the product lifecycle.

Lockheed C-130 Hercules (Air Drop)



Bell AH-1 HueyCobra



QUESTIONS?

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

Boeing B-52 Stratofortress with B-2 Spirit

