More on Initial Delay Issues

2007 DAC IBIS Summit

Lance Wang

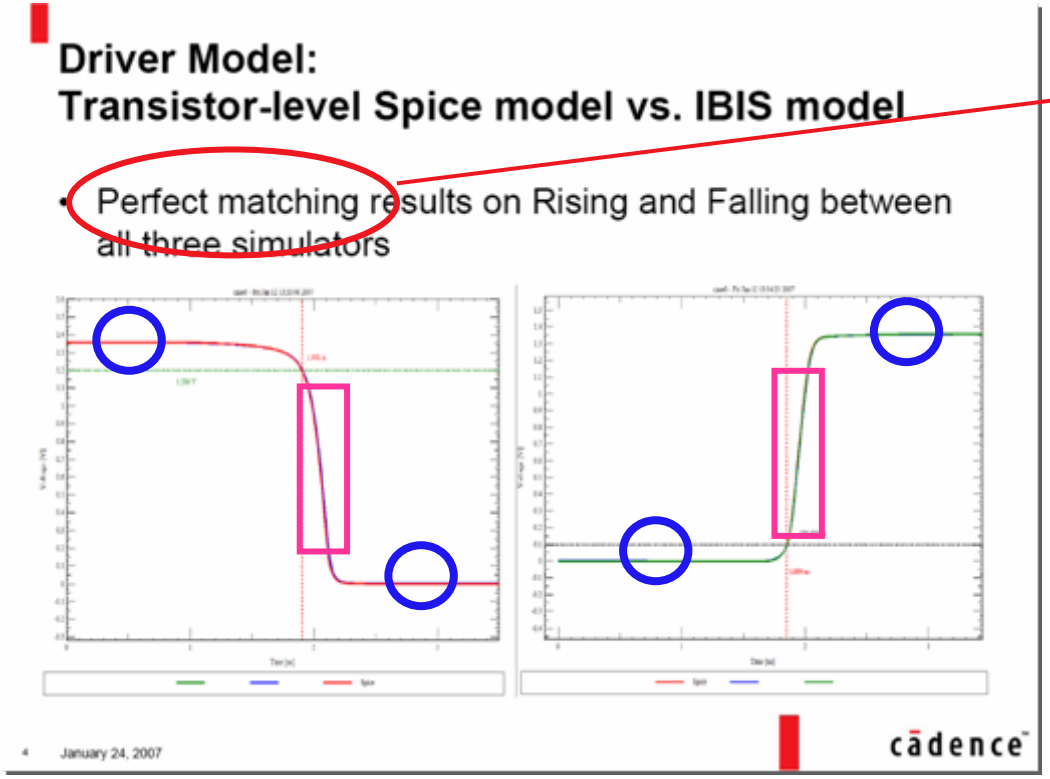
IO Methodology Inc.

lwang@iometh.com

Agenda

- Last presentation revisit
- Dive into IBIS simulation implementation
- Situations and solutions
- Conclusions

Last presentation revisit



Good for only Rising or Falling stage

VT curves reached stable zone

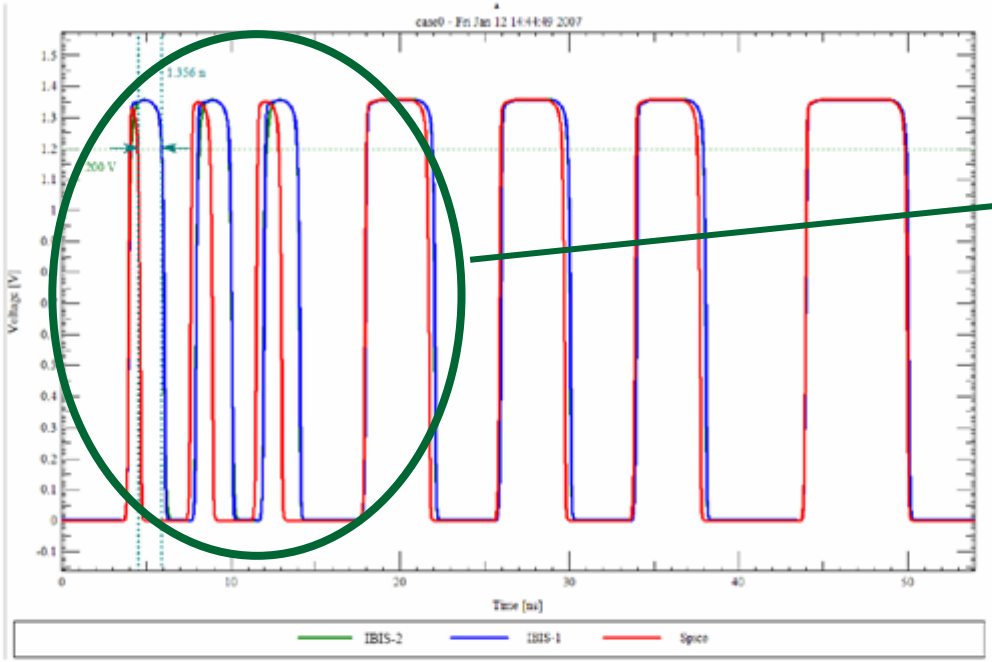
Ramp rate:
0.8v/115ps

This is a good IBIS model

Last presentation revisit

With full VT waveforms

- Stimulus patterns “0101010011001100110001110000”

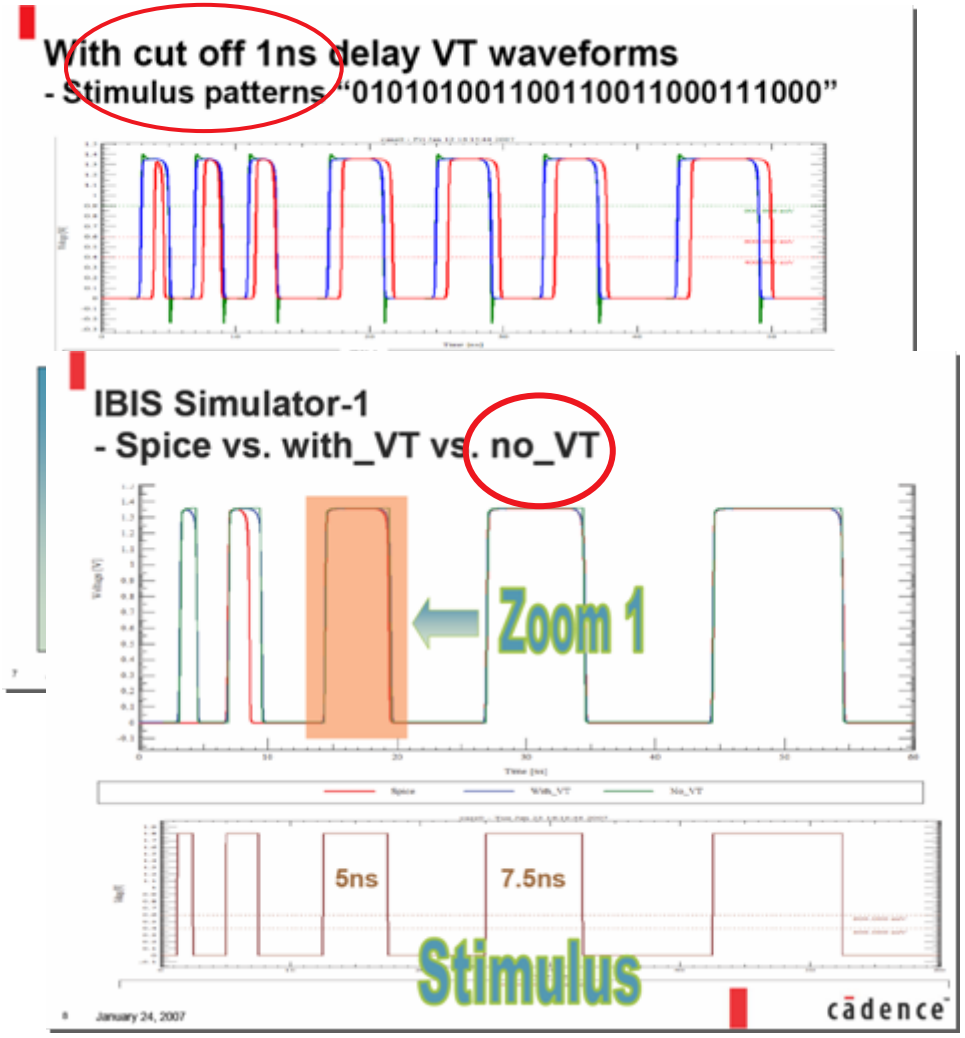


This is an ISI issue, not only timing

6 January 24, 2007

cadence

Last presentation revisit



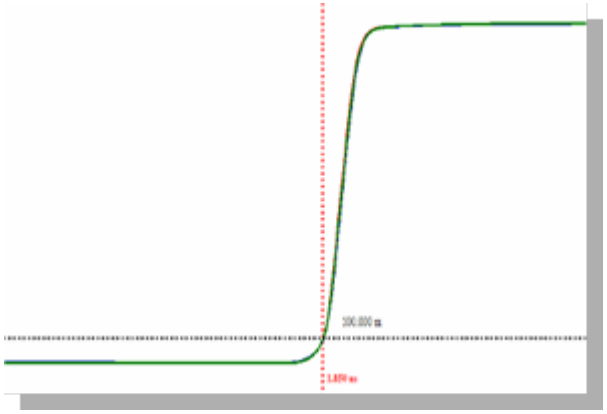
Cut out extra delay or not use VT curves does not solve the issue

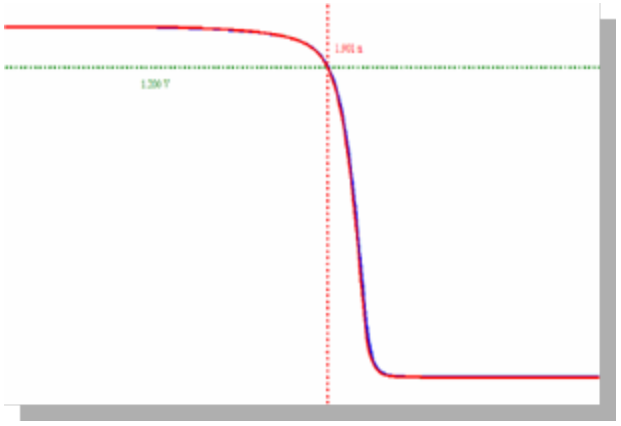
Dive into IBIS simulation implementation

General IBIS Output Equation

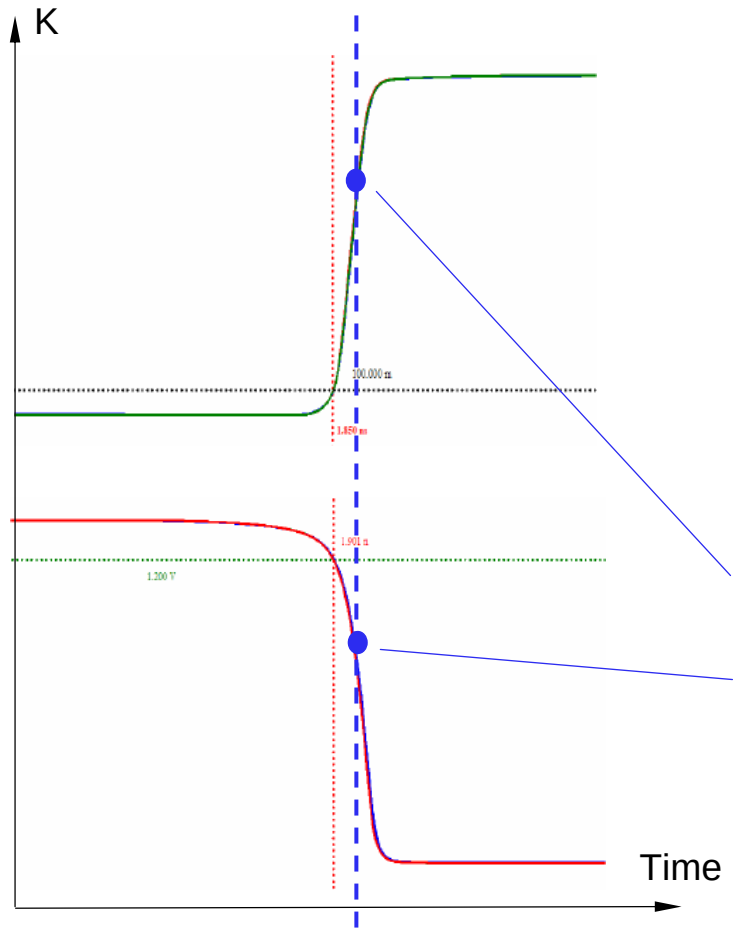
$$-I_{out}(t) = K_u(t)I_{pu}(V) + K_d(t)I_{pd}(V) + I_{pc}(V) + I_{gc}(V)$$

Important $K_u(t)$ and $K_d(t)$





Dive into IBIS simulation implementation

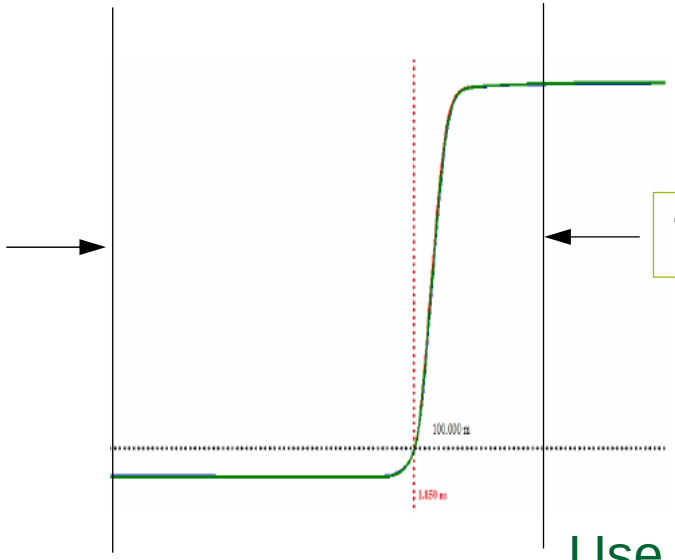


- Simulators care starting time not ending time
- Always assume both Ku and Kd will reach stable state (full state transition period)

Current IBIS implementation is not good for incomplete transition cases

Situations and solutions

- How to avoid this problem
  - Let assumptions to be true



T(r/f)s – (Rise/Fall)) Safe transition period

Rising and falling Ts may be different

Use it only when stimulus state transition time (minimum bit width) is greater than 2 x Ts

Situations and solutions

- Can simulation equation be enhanced?

  One possibility:

  $-I_{out}(t) = K_{us}(t)I_{pu}(V) + K_{ds}(t)I_{pd}(V) + I_{pc}(V) + I_{gc}(V)$

  where $K_{us}(t) = Ku(t) * f(state\_transit)$

  $K_{ds}(t) = Kd(t) * f(state\_transit)$

  f(state_transit): transition factor

Conclusions

- Current IBIS implementation is not good enough for ISI analysis
  - Cut off initial delay or not use VT curves does not solve the problems
- Your IBIS model may be not good enough for high speed digital signals
  - You will have more reasonable Error Rate analysis results if your minimum bit width is great than 2*Ts (safe transition period)
- Can IBIS output equation be enhanced?
  - One possibility is to add signal transition factor

The Hope starts here!

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