SPICE2IBIS Status and Planned Improvements

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Outline

 Research results into Spice2lbis enhancements

- Status of Spice2lbis support
- Proposed Consortia

Background

Need to account for missing predriver and other current missing in traditional IBIS model.

BIRD 95 helps add current in a restricted environment and in an insufficient way as jump in Power/Gnd voltage will not have an effect on the amount of current being added.

This method adds current that is a function of the power/gnd bounce.



Planned Improvements



Pre-Driver and Crossbar Current

- Add error correction "black box" to IBIS
 - Using spice primitives
 - No Need to wait for simulators to update for IBIS 'catch-ups'.
 - Automatic generation
 - Accurate
- $I_v ddq_{transistor} I_v ddq_{ibis} = f(V_{dd} V_{gnd})$
- Preliminary data encouraging
- Capture as spice2ibis
- Produce benchmark data set

Blackbox Experiment Details

MICRON DDR2 Model MT47H128M4BT-5E

Both parasitic placement used

- The assumption was that as long as the placement are the same in the all the 3 cases, effect should be consistent.
- C_comp split as

```
c_com_pu = 0.25
c_com_pd = 0.75
c_com_pc = 0
c_com_gc = 0
```

- Value of C_comp is = 2.28pf
- No ZVddq used
- Decoupling capacitors used
- Pin Parasitic model used to calculate Current difference
 - Pkg parasitics provided by model maker

Procedure





Rising and Falling waves



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Rising and Falling combined



- Nearly 25% improvement in simulation accuracy
- One polynomial for both edges were used
- WIP for using RISING and FALLING edges seperately for every edge

Power-Gnd Signal



Future Work

Macromodel Format

Spice2ibisX converter

- Blackbox modeling done in MATLAB

Driver Benchmark Set

- Available technologies:
 - SPICE (as golden model)
 - IBIS (plain)
 - IBIS with blackbox model
 - SPLINE functions and FTD approximations (GATECH)
 - Parametric Macromodeling (Politecnico di Torino, ITALY)
- Use real life 2D RLGC package model and non ideal T-line analysis.
- Perform High Speed analysis.

Status of Spice2lbis

- Over 2,000 downloads
- Often requires support
- Ambrish graduating towards the end of the year
- In the past, Spice2lbis supported by DARPA
- No possibility of future DARPA support

Current Levels of Support

Support provided in last 12 months:

#	Name	Name	Name	Email	Help Needed					
1	SigmaTel	Brian	Hong	bhong@sigmaTel.com		27 IDT	Charles	Sun	charles.sun@nw.idt.com	
2	ST	Fabio	BRINA	fabio.brina@st.com	extensive	28 Mentor	Tuinenga,	Paul	paul_tuinenga@mentor.com	
3	Ammos Tech	Abrar	Ahmed	abrar@ammostech.com		29 Northrop Grumman	Passerelli,	Andrew	andrew.passerelli@ngc.com	
4	Nanya Tech	Ibrahim	Murtuza	imurtuza@tx.nanva.com	extensive	30 Sunplus	Chien-Cheng	Chen	immy@sunplus.com.tw	
5	Honneywell	David	Nelson	David.C.Nelson@honeywell.com	extensive	31 Atmel	Christophe	Robichon	christophe.robichon@nto.atmel.com	
6	Atmel	Lars	Snith	Isnith@atmel.com		32	Michael	Wang	michael@maoiet.com.tw	
7	BAE	Knowles,	Kenneth	ken.knowles@baesystems.com	extensive	33 Infineon	Radovan	Vuletic	Radovan.Vuletic@infineon.com	
8	NetLogic Microsyste	Eric	Hsu	ehsu@netlogicmicro.com	extensive	34 Toshiba	Doran	David	davidd@taec.toshiba.com	extensive
9	Cisco	Mike	LaBonte	milabont@cisco.com	extensive	35 CG-Coreel	srijesh		srijesh@ca-coreel.com	extensive
10	BAE	Lawson,	David	dave.c.lawson@baesystems.com	extensive	36 HP	Lantz,	John	john.lantz@hp.com	
11	Rambus	Vaidyanath,	Arun	arunv@rambus.com	extensive	37 Wipro	Shrinivas	Uppili	shrinivas.uppili@wipro.com	
12	Ammos Tech	Sudeep	Shivalli	sudeep@ammostech.com		38 Zentel	Terry	Chien	slchien@zentel.com.tw	
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15	Cypress	Jayasree	Nayar	njy@cypress.com		41 Silicon Image	Rohan	Hubli	Rohan.Hubli@siliconimage.com	
16	AMD	Ullah,	Wasim	wasim.ullah@amd.com		42 Oplus	Michael	Barshay	michaelb@oplus.com	
17	Aeroflex	Greg	Haynes	haynes@aeroflex.com		43	Shauki	Elassaad	shauki@rio-da.com	
18	Sanyo	Vito	Cutten	vcutten@sdc.sanyo.com		44 CG-Coreel	СК	Subramanya	subramanva@co-coreel.com	extensive
19	National Hybrid	Stewart	Kushner	databus@nationalhybrid.com		45 Vitesse	Henrik	Madsen	ham@vitesse.com	
20	Conexant	ChandraShekar	Reddy	chandrashekar.reddy@conexant.com		46 Semtech	Sandy		CZheng@semtech.com	
21	Server Works	Abe	Riazi	ariazi@serverworks.com		47 Hanmir	Albert	Kim	kyshope@hanmir.com	
22	ATI	Tony	Wong	tvwono7@amail.com	extensive	48 Rockwell	Bob	Weppler	rcweppler@ra.rockwell.com	
23	Nanya Tech	Pauline	Mai	omai@tx.nanva.com		49 Bayside Design	Dee	Mehta	dee@baysidedesign.com	extensive
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25	LSI Logic	Reggie	Conley	reagie@lsil.com		51 Marvell	Itzik	Peleg	itzikpe@il.marvell.com	
26	Freescale	Srinivasan	Nandini	R10298C@freescale.com		52 TI	Baumann,	Hans-Gerhar	HGBaumann@ti.com	extensive

Possible Future Support Mechanisms?

Charge model

- Would have to start implementing now, so as to accumulate funds to start new PhD student next year
- Do individuals needing support have budget?
 - I would expect not.

Consortia model

- Fund as part of broader activity (see next slide)
- CAD vendors unlikely to join consortium (see next bullet)

"Relationship" model

- CAD vendors main beneficiary of Spice2Ibis
- Vendor support in return for enhancements?
- Most likely model to work

Digital System Design Consortia

At concept stage (with GaTech)

- Industry-funded consortium
 - Full membership: \$100,000 per year
 - Consortium members select projects
 - Gain IP rights and early access to talent + build relationships with other consortia members
- Focus on digital system I/O and SI issues
- Possible activities:
 - Tool production and enhancements
 - Deliver SI control methods and technologies
 - Measurement techniques and support
- Fund projects at a broad range of Universities

Conclusions

- Plan to deliver a "black box" enhancement to IBIS that will better support SSN
 - Will validate across wide buffer set
 - Will be available in Matlab Spice2Ibis format
- Need to develop a plan to provide continuing support to Spice2lbis

Suggest CAD vendor lead support effort

 Gathering interest in possible digital system design consortium