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BIRD 104.1 – AMI Model – New IBIS Support

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Overview

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- **Motivation**
- **Classical Way of IBIS**
  - **ASCII – File**
  - **Simulation Tool „creates“ the simulation-model**
- **BIRD104.1**
- **AMI approach for SERDES**
  - **definition**
  - **DLL- File**
  - **advantages**
- **Summary**

What is AMI? Why AMI ?

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- **Questions from customer**
- **Questions from IBIS user**
- **Curiosity of BIRD104.1**
- **Different presentations in the last 2 years**
  - **Examples of AMI modeling from Cadence and SiSoft**
  - **IBIS AMI Model Developers Toolbox (H. Shah / Cadence)**

„Classical“ type of IBIS model

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- **ASCII file in a very detailed specified format**
- **Parameter & Tables:**
  - **description of the I/O-behavior under certain loads**
- **IBIS File - „standalone“**
  - **„readability“**
  - **usefull information gained w/o simulator**
  - **quality of the information ➔ more or less ➔ evidently**

Improvements of IBIS models

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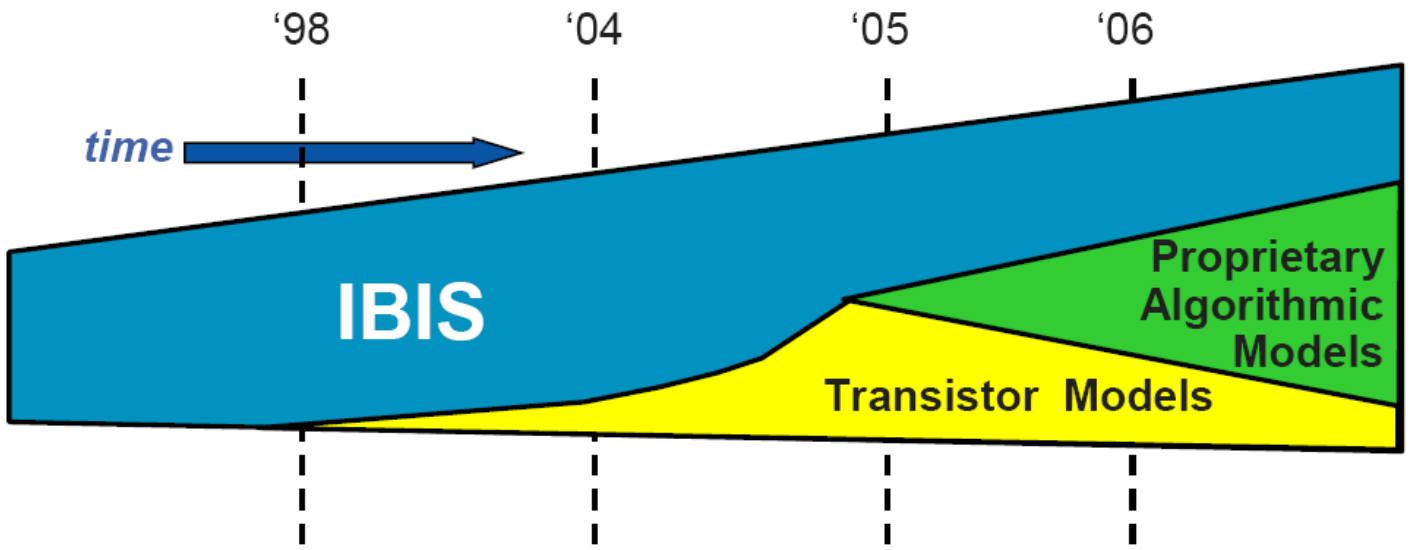
- **Driver Schedule / Submodel / Series MOSFET**
- **External Model**
  - **VHDL – AMS**
  - **SPICE model**
- **Algorithmic Modeling Interface (AMI)**
  - **a new quality of model**

Distribution of the model types

Modeling Background



Ambrish Varma & Co./ @ DesignCon 2008 / Cadence/IBM/Mathworks

Reason for BIRD104.1

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- **SERDES**
  - above 5 GHz
  - difficult to simulate
    - Equalization / Feed back / CLK recovery
    - long bit streams (> 10 million UI)
- **Each SERDES IP vendor**
  - proprietary SW to solve
  - NO interoperability / compatibility
    - Models / EDA tools
    - Different vendors
- **Solution ➔ AMI specified in BIRD104.1**

Mean topics of BIRD104.1 (1 / 2)

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Definitions

- Parameter (IN / OUT / INOUT)
- Type (Integer / Float / String / Boolean / TAP / UI)
- Format (Value / Range/ List / Corner / Inc. / Step / Table)
- Keywords [Algorithmic Model] [End Algorithmic Model]
- Subparameters: Executable
  - Platform_Compiler_Bit
  - File_Name
  - Parameter_File
    - Reserved
      - Init_Return_Impulse / GetWave_Exists / Max_Init_Aggressors
    - Model_Specific (optional) e.g. tap
- User defined parameter
  - Tx_Jitter / Tx_DCD (duty-cycle-distortion)
  - Rx_Clock_PDF (prob.dens.func.) / Rx_Receiver_Sensitivity

Mean topics of BIRD104.1 (2 / 2)

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Function Signatures

- AMI_INIT ➔ Initialisation
  - Declaration
  - Arguments (e.g. impulse_matrix, aggressors, parameters etc.)
- AMI_GetWave ➔ simulation ➔ convolution
  - Declaration
  - Arguments (e.g. wave, wave_size, clock_times etc.)
- AMI_Close ➔ termination
  - Declaration
  - Return value
  - Free memory space

Algorithmic Modeling

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- **I/O model (IBIS / SPICE)**
- **Channel Information**
- **Source & Sink circuits**
  - **Preemphasis / Equalizer**
  - **Clock & Data recovery**
  - **Feed back**
- **Control Parameter (by user)**
  - **Input Waveform format**
  - **Jitter / Noise amount**
  - **Bitpattern typ**

➔ ➔ **packed into a Dynamic Linked Library (DLL)**

Structure of a AMI model

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- Can be described within the IBIS framework
- Two parts of a AMI model:
  - electrical / analog
    - Transmitter / Receiver
    - Channel
    - characterized by means of an impulse response
    - considered linear + time invariant
  - algorithmic
    - Equalization
    - Clock & Data recovery etc.
    - connected by high Zo to the analog part
    - modeled by executable code (C++ / Matlab)

Summary

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- **Advantages of the AMI models**
  - **maximal flexibility / compatibility / interoperability for SERDES**
  - **protection of proprietary information**
  - **Contains the**
    - **Tx+Rx**
    - **the whole channel**
    - **simulation environment**
  - **Short simulation time / millions of UI**

- **Disadvantages**
  - **NO more a ASCII file, but a DLL**

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Questions