Using IBIS-AMI in COM Analysis

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Wei-hsing Huang, SPISim
Wei-hsing.Huang@spisim.com
Agenda:

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• Background
• Using AMI in COM Flow
• Results
• Summary
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Motivation

• **AMI model development**:
  - Model is not an executable, it needs driver
  - Spawn child (simulation) processes is tricky to debug
  - Optimization/flow is beyond model developer’s control

• **Open source link-analysis platforms**
  - Includes useful building blocks (e.g. Figure of Merits, BER)
  - Mostly use generic Tx/Rx EQ blocks/algorithms
  - Can be adapted to use IBIS-AMI models
  - Can shorten AMI modeling design cycle
  - E.g. COM (1), (2) & PyBERT (3)
Background 1/3

- **COM (Channel operating Margin)**
  - Is a IEEE 802.3bj Spec (Annex 93A)
  - Published codes, well documented and maintained
  - Is a simplified version of BER analysis
  - Figure of merit based channel optimization and analysis
  - Jitter, Noise etc are also included

\[
COM = 20 \log_{10} \left( \frac{A_s}{A_n} \right)
\]
Background 2/3

- COM has channel components and conditioning algorithms

- Use FOM to find FFE, CTLE settings, then apply DFE for BER

- Single-bit-response based
• COM use exhaustive search for FFE + CTLE \(^{(4)}\)
  o Generic implementations
  o CTLE is gdc only
  o DFE is not optimized together
Use AMI models in COM 1/2

Original COM flow

- Package iteration loop
- CTLE gdc iteration loop
- FFE taps iteration loops
- FOM Calculation
- DFE

AMI_INIT call to CTLE (Rx)
AMI_INIT call to FFE (Tx)
Array/optimization control loops

FOM Calculation
DFE

Modified COM flow using AMI_Init

(5)
Use AMI model in COM 2/2

- Use loadlibrary mechanism
- AMI parameters can be pre-assembled
- Example library loading/calling in COM

Modified COM flow using AMI_GetWave (Bit-by-bit)
Example Results 1 \((6), (7)\)

- Replace COM’s FFE with self-optimization FFE
Example Results 1

- 13 gdc * 24 FFE sweep (red) vs customized FFE (blue)
Example Results 2

- 13 gdc * 24 FFE sweep (red) vs customized FFE (blue)
Summary:

● AMI model can be used in COM analysis:
  ○ COM is a great open platform for link analysis/AMI development
  ○ Replaces multi-level CTLE and FFE loops with AMI call
  ○ Can pull-in DFE for co-optimization

● Considerations:
  ○ Original COM flow supports AMI_Init type LTI only
    ■ AMI_GetWave based flow needs SBR ⊗ BitStream first
  ○ AMI parser is not necessarily needed
    ■ Parameters can be pre-assembled as strings
  ○ Can be used for back-channel analysis development
References:

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5. IBIS V6.1 Spec. Section 10 http://ibis.org/ver6.1/
6. New SI Techniques for Large System Performance Tuning, Donald Telian, DesignCon 2016
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Q & A