Using IBIS-AMI in COM Analysis

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Agenda:

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

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

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

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

\[ COM = 20 \log_{10} \left( \frac{A_2}{A_{n1}} \right) \]
Background 2/3

- COM has channel components and conditioning algorithms

\[ H_{tot}(f) \]

\[ H_{21}(f) = s21(f) \]

- 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
Use AMI model in COM 2/2

Modified COM flow using AMI_GetWave (Bit-by-bit)

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

```matlab
mex -setup
load('SPIsimAMI_WIN64.dll', 'ami.h')
libisloaded('SPIsimAMI_WIN64')
calllib('SPIsimAMI_WIN64', 'ami_init', hInput, rowSize, numAggr...)
unloadlibrary('SPIsimAMI_WIN64')
```
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 loop 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:

1. IEEE Std 802.3bj-2014, Specification, Annex 93A
2. Channel Operating Margin (COM), Richard Mellitz, DesignCon 2013
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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
7. Sam Palermo, ECEN 720, High-Speed Link Circuits & Systems, Texas A&M
Q & A
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