How a Linear Filter Could Be Added to COM Based on Hegde_3bs_01_0715

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08-11-2015

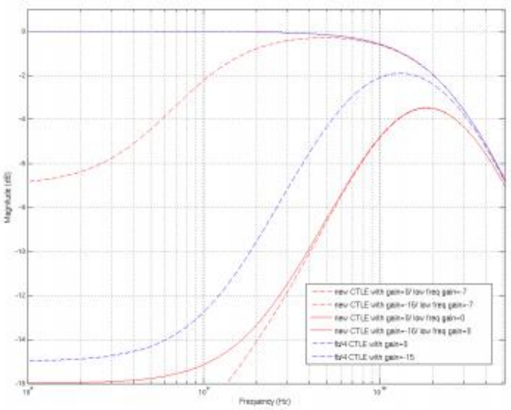
Review

- From hegde_3bs_01_0715.pdf

CTLE AND OTHER TX MODIFICATIONS

BROADCOM.

- **Increase CTLE b/w to fb/2**
- **A 2nd pole-zero pair is introduced at 1G (CTLE-LOW)**
  - Configuration is similar to the main CTLE
  - DC gain range set to [-7:0] dB
- **Relax SNR_TX to 29dB**
- **Increase level-mismatch Ratio to 0.95**



COM implementation

Parameter	Symbol	Value	Units
Signaling rate	f_b	26.5625	GBd
Maximum start frequency	f_{min}	0.05	GHz
Maximum frequency step	Δf	0.01	GHz
Device package model Single-ended device capacitance Transmission line length, Test 1 Transmission line length, Test 2 Single-ended package capacitance at package-to-board interface	 C_d z_p z_p C_p	 TBD 12 30 TBD	 nF mm mm nF
Single-ended reference resistance	R_0	50	Ω
Single-ended termination resistance	R_d	TBD	Ω
Receiver 3 dB bandwidth	f_r	0.75 × f_b	
Transmitter equalizer, minimum cursor coefficient	c(0)	0.60	—
Transmitter equalizer, pre-cursor coefficient Minimum value Maximum value Step size	c(–1)	 –0.15 0 0.05	 — — —
Transmitter equalizer, post-cursor coefficient Minimum value Maximum value Step size	c(1)	 –0.25 0 0.05	 — — —
Continuous time filter, DC gain Minimum value Maximum value Step size	g_{DC}	 –15 0 1	 dB dB dB
Continuous time filter, zero frequency	f_z	f_b / 4	GHz
Continuous time filter, pole frequencies	f_{p1} f_{p2}	f_b / 4 f_b	GHz
Transmitter differential peak output voltage Victim Far-end aggressor Near-end aggressor	 A_v A_{fe} A_{ne}	 0.4 0.4 0.6	 V V V

Fb/2
Fb/2
Fb*2

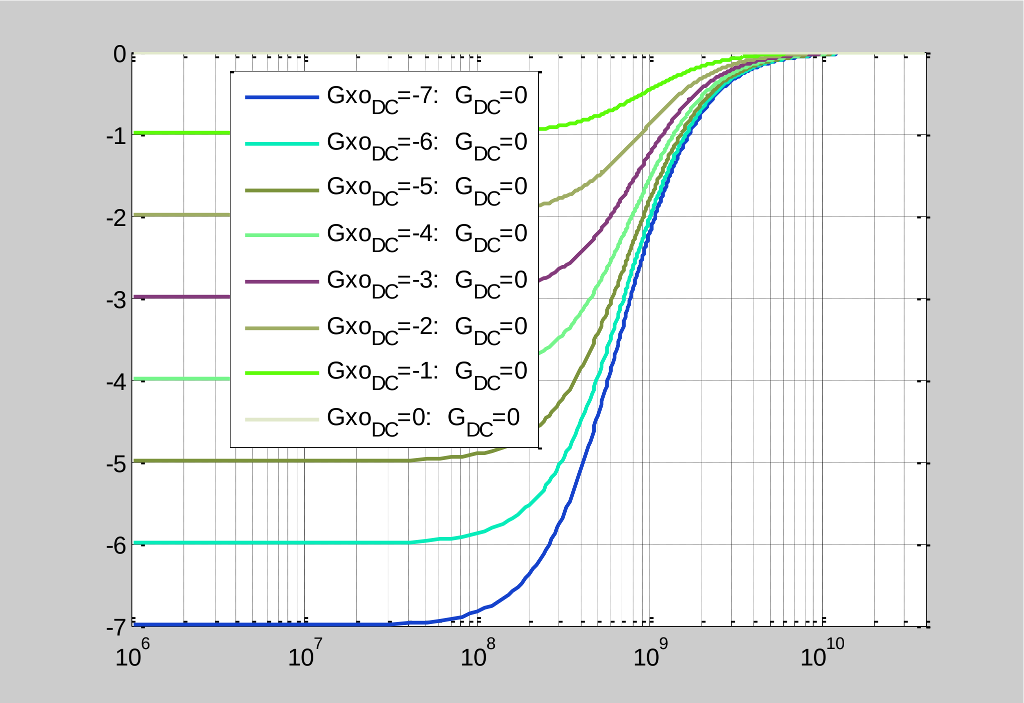
- Cascade a crossover filter with same pole zero with the original COM continuous time filter

Crossover Filter DC Gain Min Value Max Value Step	gxo_{dc}	 -7 0 1	 dB dB dB
Crossover filter pole and zero	f_{xo}	1	GHz

For 50Gb/s per Lane

- Response of crossover liner filter for dc gains for 0dB to -7dB

- $$H_{xo}(f) = \frac{\left(10^{\frac{gxo_{dc}}{20}} + \mathrm{j}\frac{f}{f_{xo}}\right)}{\left(1+\mathrm{j}\frac{f}{f_{xo}}\right)}$$



For 50Gb/s per Lane

- Annex 93A.1.4

93A.1.4 Filters

The voltage transfer function for each signal path $H_{21}^{(k)}(f)$ (see 93A.1.3) is multiplied by a set of filter transfer functions to yield $H^{(k)}(f)$ as shown in Equation (93A–19).

$$H^{(k)}(f) = H_{ffe}(f)H_{21}^{(k)}(f)H_r(f)H_{ctf}(f) \quad (93A\text{–}19)$$

The receiver noise filter $H_r(f)$ is defined in 93A.1.4.1, the transmitter equalizer $H_{ffe}(f)$ is defined in 93A.1.4.2, and the receiver equalizer $H_{ctf}(f)$ is defined in 93A.1.4.3.

The filtered voltage transfer function $H^{(k)}(f)$ is used to compute the pulse response (see 93A.1.5).

  - For 50Gbs: $H^{(k)}(f) = H^{(k)}(f)H_{xof}(f)$

- Annex 93A1.6 for 50Gb/s per lane:
  - COM is a function of the variables c(−1), c(1), and g_{DC}

Becomes

  - COM is a function of the variables c(−1), c(1), g_{DC}, and gxo_{DC}

Aggregate linear filter response for G_{DC}= 0 to -15 dB and Gxo_{DC}=0 to -7 dB