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Study Of Distributed RLCG Network System For Ramp Input

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Abstract

In this paper we have put forward an analytical model, which could accurately capture the on-chip Network delay. As we move onto higher frequency range, of the order of GHz, the effects of shunt conductance cannot be ignored, as that provides a measure of the possible leakage. Due to this reason, we have derived our on-chip Network delay metric considering distributed RLCG segments, rather than sticking to the conventional RLC and RC. We develop a novel analytical model based on the first and second moments of the Network transfer function when the input is a ramp signal. Delay estimate using our first moment based analytical model is within 4% of SPICE-computed delay, and model based on first two moments is within 5% of SPICE, across a wide range of Networks parameter values.

Keywords: - Wavelet Detection , Covariance Detection ,RLCG

1. Introduction

The advancements in design and manufacturing capabilities for each module results in more challenges for researchers in this field. According to the International Technology Roadmap for Semiconductor (ITRS) [1], the off-chip frequencies for high performance semiconductor products over the next decade should reach as high as 2 GHz.

2. ESTIMATION OF DELAY FOR RAMP INPUT

We develop a novel analytical model based on the first and second moments of the Network transfer function when the input is a ramp signal.

$$T_D = T_{fe} + 0.5 \quad (1)$$

The above Eqn.(1) is our proposed closed form expression for delay for lossless transmission line RLCG tree circuit in even mode and with mutual inductance.

$$T_D = T_{fo} + 0.5 \quad (2)$$

The above Eqn.(2) is our proposed closed form expression for delay for lossless transmission line RLCG tree circuit in Odd mode and with mutual inductance.

3. Experimental Result

In the case of very high frequencies as in GHz scale, inductive effect comes into the important role and it should be included for complete delay analysis. The configuration of circuit for simulation is shown in Fig.3.

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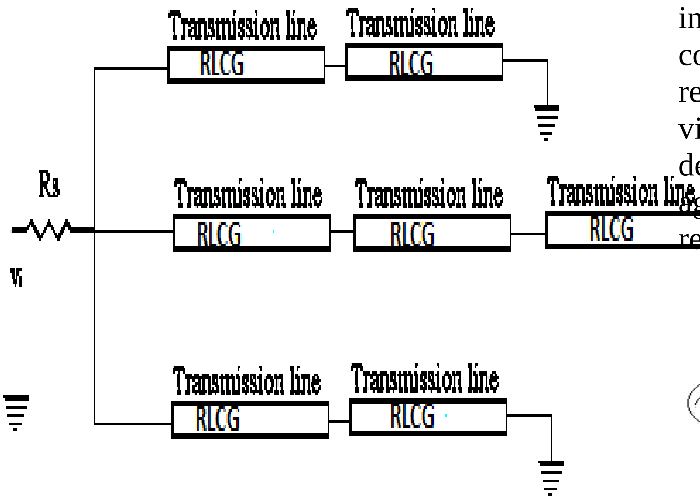

Fig.1 .An RLCG Tree Example

For each RLCG network source we put a driver, where the driver is a step voltage source followed by a resistor. The results are based on Eqn. (2) for 0.18 µm process. The left end of the first line of Fig.1 is excited by 1V ramp form voltage with rise/fall times 0.5 ns and a pulse width of 1ns. In table 3.2, the 50% delay for even mode and the Elmore delay is compared for various values of the driver resistance R_D and the load capacitance C_L when the length of the RLCG Network is kept constant. In the similar way, in table 3.3 the 50 % delay for odd mode and the Elmore delay are compared[2-4].

2.4.2 Odd Mode

When two coupled transmission lines are driven with voltages of equal magnitude and 180^0 out of phase with each other, odd mode propagation occurs. The effective capacitance of the transmission line will increase by twice the mutual capacitance, and the equivalent inductance will decrease by the mutual inductance . In Fig.2, a typical transmission line model is considered where the mutual inductance between aggressor and victim connector is represented as M_{12}. L_1 and L_2 represent the self inductances of aggressor and victim nodes, respectively, while C_c, C denotes the coupling capacitance between aggressor and victim and self capacitance, respectively.

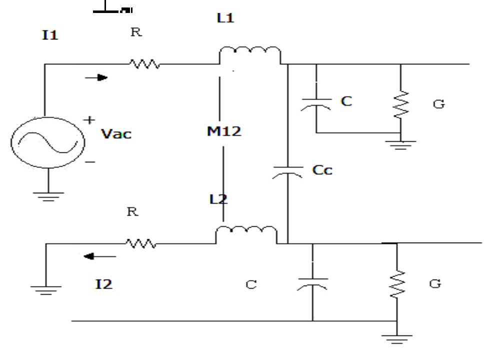

Fig. 2.An Example for Two Parallel Transmission Line Model

Assuming that $L_1 = L_2 = L_0$, the currents will be of equal magnitude but flow in opposite direction . Thus, the effective inductance due to odd mode of propagation is given by,

$$L_{odd} = L_1 - L_2$$

The magnetic field pattern of the two conductors in odd-mode is shown in Fig.3.

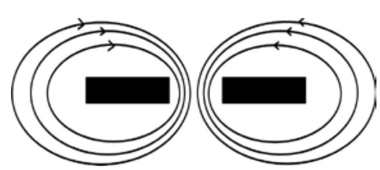

Figure 2 Magnetic Field in Odd Mode

TABLE 1 Experimental Result Under Ramp Input for Odd Mode also predits the same[5-8].

Ex.	R_s (Ω)	C_L (fF)	L (µm)	T_{ED} (ps)	Proposed Model Delay (ps)
1	1	10	100	0.1125	0.1237
2	2	25	100	0.2345	0.2546
3	5	50	100	0.4745	0.4989
4	10	750	100	0.9823	0.9992
5	50	1000	100	1.1224	1.3974
6	100	1500	100	1.6732	1.7689

References

[1] Semiconductor Industry Association, 2001.Edition.International Technology Roadmap for Semiconductors.

[2] A. Fracy, B. Flechet and C. Bermond, V. Arnal, J. Torres, G LeCarval, G. Angenieux, and R. Salik,2002. “Impact of Dielectrics and Metals Properties on Electrical Performances of Advanced On-Chip Network,” *Proceedings of the International Network Technology Conference*, 2002, p. 161-163

[3] S. Jang, T. Chou and Y. Chen, S. Lee, C. Chen, T. Tseng, B. Chen, S. Chang, C, Yu, and M. Liang,2002. “Advanced Cu/Low-k (k=2.2) Multilevel Network for 0.10/0.07 □m Generation,” *Symposium on VLSI Technology Proceedings*, 2002, p. 17-18.

[4] M. Anders, N. Rai, R. Krishnamurthy and S. Borkar.2002. “A Transition-Encoded Dynamic Bus Technique for High-Performance Networks,” *Symposium on VLSI Circuits Proceedings*, 2002, p. 16-17.

[5] L. T. Pillage.1995. “Coping with RC(L) Network design headaches”. Proceedings of the IEEE/ACM International Conference on Computer- Aided Design, pp. 246-253, September 1995.

[6] E. G. Friedman,J. L. Neves and Y. I. Ismail, 1998, “Figures of merit to characterize the importance of on-chip inductance”. Proceedings of the IEEE/ACM Design Automation Conference, pp. 560-565, June 1998.

[7] F. R. Awwad, and M. Nekili.2001. “Regeneration techniques for RLC VLSI Networks”. Proceedings of the International Conference on Microelectronics, Morocco, pp. 209-212, Oct. 2001

[8] S.Jain et.al.,Microstrip moisture sensor based on microstrip patch antenna, Progress in electromagnetic research -M, vol. 76, pp 175-185, 2018.