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OptoWin 2020
광산업전시회
Optical Society of
Korea Summer Meeting

한국광학회

07. 13 Mon ——— 부산
15 Wed BEXCO
컨벤션홀

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시간 \ 장소	101호(A)	102호(B)	103호(C)	104호(D)	105호(E)	201호(F)	202호(G)
13:30~15:00	Tutorial I 이병호(서울대)	리소그래피	OSK Rising Stars 30 특별 심포지엄I	OSK Rising Stars 30 특별 심포지엄II	OSK Rising Stars 30 특별 심포지엄III	분과 학생우수논문 특별 세션III	디스플레이III
	좌장 : 김경염(세종대)	좌장 : 김성환(아주대)	좌장 : 최현용(서울대)	좌장 : 이승열(경북대)	좌장 : 김대근(단국대)	좌장 : 이일민(ETRI)	좌장 : 송장근 (성균관대)
	M3A-S	M3B-IX	M2C-S	M3D-S	M3E-S	M3F-S	M3G-VII
15:00~15:15	Coffee Break						
15:15~16:45	광과학III	광융합기술 특별 세션 (15:15~17:05)	OptoWin 2020 광산업 세미나	포토닉스III	Photonic medical device commercialization I	광기술I	디지털홀로그래피 및 정보광학I
	좌장 : 김수진(고려대)	좌장 : 백종협(KOPTI)	좌장 : 김장선 (㈜팬옵틱스)	좌장 : 서민교(KAIST)	좌장 : 정필상(단국대)	좌장 : 박준규(KASI)	좌장 : 오관정(ETRI)
	M4A-I	M4B-S	M3B-S	M4D-V	M4E-S	M4F-II	M4G-III
16:45~17:00	Coffee Break						
17:00~18:30	광과학IV		양자전자II	포토닉스IV	Photonic medical device commercialization II	광기술II	디지털홀로그래피 및 정보광학II
	좌장 : 김명기(고려대)		좌장 : 김종환 (POSTECH)	좌장 : 송봉식 (성균관대)	좌장 : 엄주범(단국대)	좌장 : 김영진(KAIST)	좌장 : 최기홍(ETRI)
	M5A-I		M4C-IV	M5D-V	M5E-S	M5F-II	M5G-III

M3F-S : 분과 학생우수논문 특별 세션 III

좌장: 이일민(한국전자통신연구원)

Room 201호(F), 07월 13일 (월) 13:30 - 15:00

13:30 (초청강연) **M3F-S-1**

100 Gb/s silicon photonic WDM transmitter with ring modulators

*김민규(연세대학교), 박강엽, 오원석(전자부품연구원), Christian Mai, Stefan Lischke, Lars Zimmermann(Innovations for High Performance Microelectronics), *최우영(연세대학교)

14:00 (초청강연) **M3F-S-2** 온라인 발표

Parameter Correction Method for Optical Quadrature Detection in a 3×3 Fiber-Optic Coupler Based Interferometer

박승호, 김영규, *이병하(광주과학기술원)

14:30 (초청강연) **M3F-S-3**

Multi-functional beam manipulation enabled by an all-dielectric metasurface doublet

Changyi Zhou, 이우빈, 박철순, Song Gao(광운대학교), 최덕용(Australian National University), *이상신(광운대학교)

100 Gb/s Silicon Photonic WDM Transmitter with Ring Modulators

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***Abstract*— We demonstrate a 100-Gbps (4x25-Gbps) Si Photonic WDM transmitter containing monolithically integrated Si ring modulators (RMs) and BiCMOS driving circuits. Our transmitter is designed with the large-signal circuit model for the Si RM, which allows optimization of the entire transmitter.**

I. Introduction

Depletion-type Si ring modulators (RMs) attract a great amount of research interests because they provide high modulation bandwidth along with the small footprint and the wavelength-division multiplexing (WDM) capability. These advantages can be further enhanced by the monolithic integration of RMs and driving circuits. Also, it is highly desirable if the entire WDM transmitter performance can be simulated in the standard IC design environment. We reported an accurate and easy-to-use large-signal circuit model for a RM [1] and, in this paper, present a 4x25-Gbps WDM transmitter whose performance is optimized based on the SPICE simulation of the RMs and the driving circuits.

II. Monolithic WDM Transmitter

Fig. 1 shows the block diagram of our monolithic WDM transmitter containing pre-drivers, emitter-follower (EF) buffers, modulator driver circuits, and Si RMs. The target FSR of the Si RMs is 12nm and the target WDM channel spacing is 3nm around λ=1310nm.

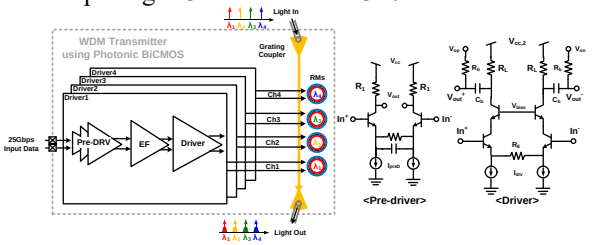

Fig.1. Block diagram and schematic of the WDM transmitter

Fig. 1 also shows the schematics for driver circuits implemented with SiGe BiCMOS technology. The pre-driver uses RC degeneration for high-speed operation. The driver has resistive degeneration and is connected to the Si RM with capacitive coupling. The cascade structure is used so that the driver can deliver up to 4-$V_{p2p,diff}$ swing to the RM from 4.5V supply without transistor breakdown.

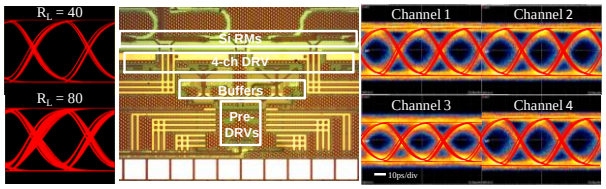

Fig. 2. (a) Simulated eye-diagram for 25-Gb/s with different load impedance of the driver IC, (b) chip photo of the transmitter and (c) 25-Gb/s NRZ measured results for four different channels with simulated results (solid)

Using the RM circuit model [1], the monolithic Si WDM transmitter is designed and fabricated by IHP's Photonic BiCMOS foundry service, which provides high-performance 0.25-μm SiGe BiCMOS circuits and Si photonic components on the same wafer. For the optimization of the transmitter performance, careful selection of the load impedance (R_L) for each driver circuit is important since it determines the driver bandwidth as well as the power consumption. Fig. 2(a) shows the simulated eye diagrams for the entire transmitter having two different R_L values. Fig. 2(b) shows the photo of the fabricated chip whose active area is 0.16mm^2. Fig. 2(c) shows the measured 25-Gb/s NRZ eye diagrams. Also shown are the SPICE simulated eye diagrams which agree well with the measured results [2]. More details of our design optimization and measured results will be presented.

Acknowledgements

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References

[1] M. Kim et al., "Large-signal SPICE model for depletion-type silicon ring modulators," Photonics Res., vol. 7, no. 9, p. 948, Sep. 2019.

[2] M. Kim et al., "A 4×25-Gbps Monolithically Integrated Si Photonic WDM Transmitter with Ring Modulators," in 2019 IEEE Optical Interconnects Conference (OI), 2019, pp. 1–2.