

UWB over Fiber

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ABSTRACT

The aim of this work is to develop a nonlinear model for Optical millimeter-wave signal generation by up and/or down-conversion system based on simple technologies, which can tend to be low-cost, vital to future real deployment in access networks.

A Mach Zehnder interferometer (MZM) is used to generate high frequency optical OFDM signals by means of its nonlinearity.

The maximization is based on the Taylor series expansion.

INTRODUCTION

- Several optical mm-wave generation approaches were reported recently, such as direct modulation, optical double-frequency heterodyning [1], external optical modulation [2], [3],[4] etc.
- We focus on the simplification of the central office (CO) and of the base station (BS) by optical generation/detection of mm waves and signals.

Simulation set-up

Simulation set-up (Fig. 1),

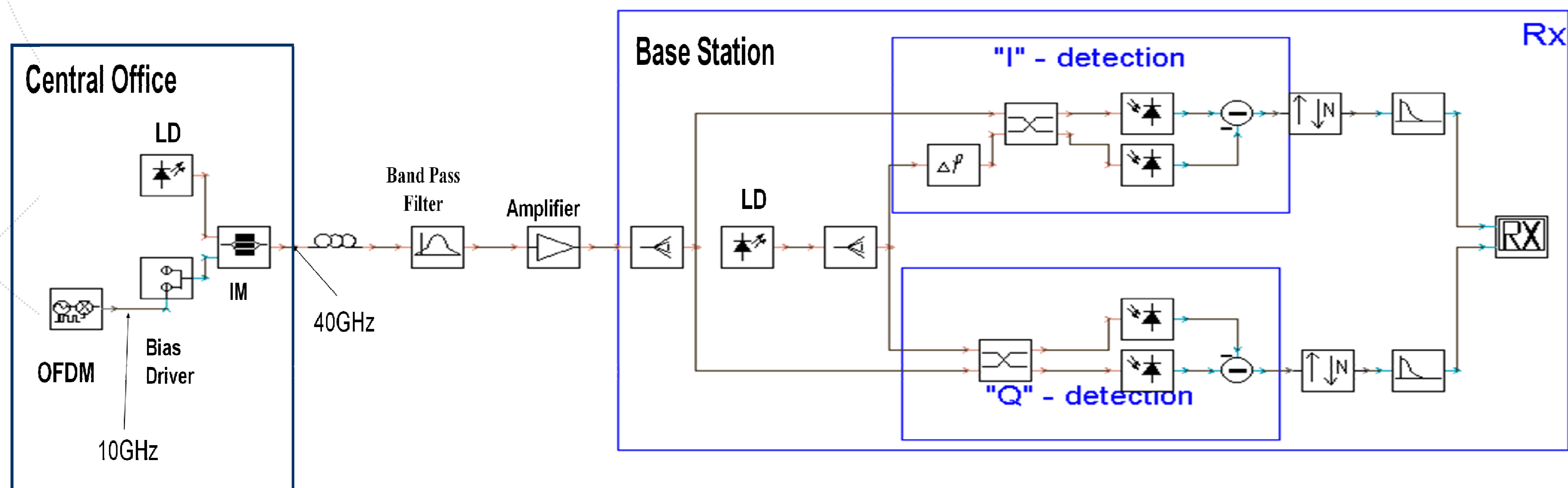
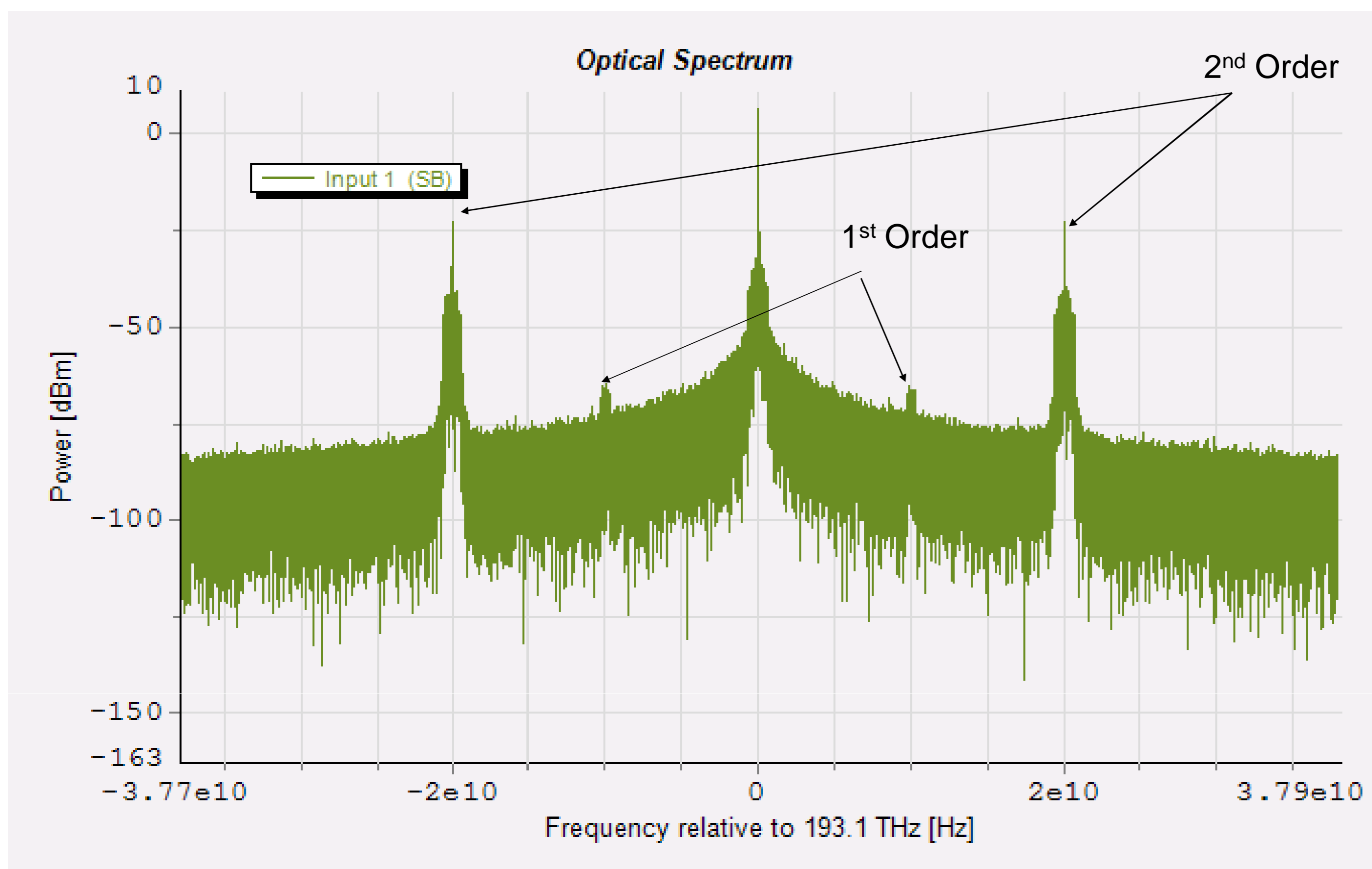


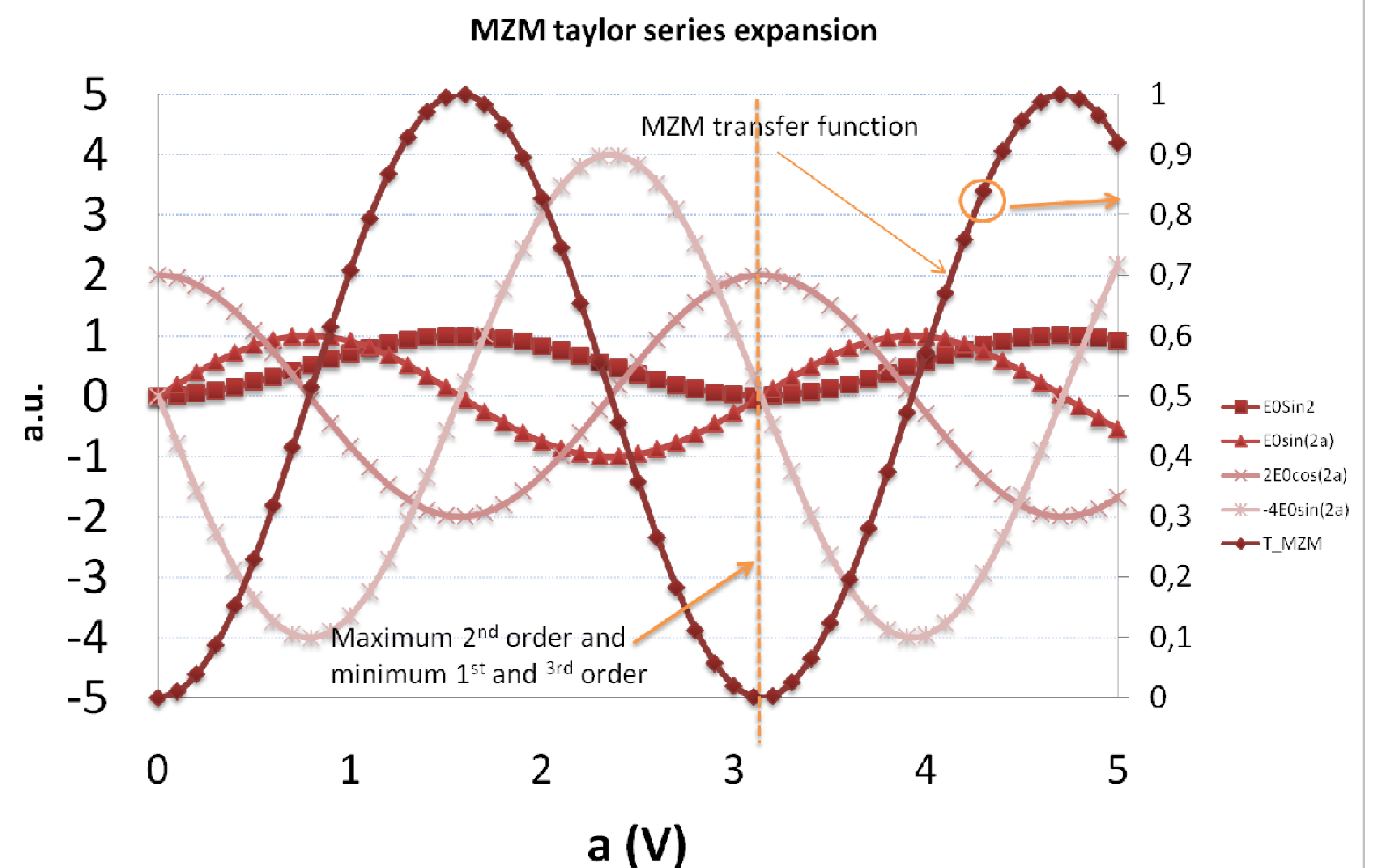
Fig. 1. Double-Sideband Modulation & Coherent Heterodyne Detection Architecture . (LD: laser diode, IM: intensity modulator) Simulation setup .

1st SIMULATION RESULTS



Fig(2) Simulation result of the generation of the optical millimeter-wave (mm-wave) using one MZM intensity modulator (IM) and a 10 GHz local oscillator (LO).

- 1st order is suppressed and 2nd order appears stronger



Fig(3) V bias Vs Second Order of Power Series at Different Expansion Point a

- V bias equal to 3.1 V minimizes all other components and maximizes 2nd

The MZM power transfer function can be approximated by

$$f(V_{bias}) = E_0 \sin^2(kV_{bias}) \quad (1)$$

•the laser diode power (E_0) and the bias point (V_{bias}), k is a calibration constant

•The Taylor power series for equation (1) follows (a - the expansion point) :

$$f(V_{bias}) = E_0 \sin^2(a) + E_0 \sin(2a) \frac{V_{bias} - a}{1!} + 2E_0 \cos(2a) \frac{(V_{bias} - a)^2}{2!} - 4E_0 \sin(2a) \frac{(V_{bias} - a)^3}{3!}$$

CONCLUSION

- We confirm that it is possible to generate optical 40GHz millimeter-wave (mm-wave) just by adjusting the bias point and a oscillator of 10GHz.
- The Taylor series is an important tool for that purpose.
- Further research is going on, on enabling Coherent Heterodyne Detection of High-Bit rate OFDM.

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