Optics Communications 344 (2015) 139–146

Contents lists available at ScienceDirect

Optics Communications

journal homepage: www.elsevier.com/locate/optcom

Optical frequency comb generation based on chirping of Mach–Zehnder Modulators

Jassim K. Hmood [a,b], Siamak D. Emami [a], Kamarul A. Noordin [a], Harith Ahmad [c], Sulaiman W. Harun [a,c,*], Hossam M.H. Shalaby [d]

[a] Department of Electrical Engineering, Faculty of Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia
[b] Laser and Optoelectronic Department, University of Technology, Baghdad 10066, Iraq
[c] Photonics Research Center, University of Malaya, Kuala Lumpur 50603, Malaysia
[d] Department of Electronics and Communications Engineering, Egypt-Japan University of Science and Technology, Alexandria 21934, Egypt

ARTICLE INFO

Article history:
Received 14 November 2014
Received in revised form
15 January 2015
Accepted 19 January 2015
Available online 21 January 2015

Keywords:
Chirp factor
Optical frequency comb
Optical fiber communication
Optical modulator

ABSTRACT

A new approach for the generation of an optical frequency comb, based on chirping of modulators, is proposed and numerically demonstrated. The setup includes two cascaded Mach–Zehnder Modulators (MZMs), a sinusoidal wave oscillator, and an electrical time delay. The first MZM is driven directly by a sinusoidal wave, while the second MZM is driven by a delayed replica of the sinusoidal wave. A mathematical model of the proposed system is formulated and modeled using the Matlab software. It is shown that the number of the frequency lines is directly proportional to the chirp factor. In order to achieve the highest number of frequency comb lines with the best flatness, the time delay between the driving voltages of the two MZMs is optimized. Our results reveal that at least 51 frequency lines can be observed at the output spectrum. In addition, 27 of these lines have power fluctuations of less than 1 dB. The performance of the proposed system is also simulated using a split-step numerical analysis. An optical frequency comb, with tunable frequency spacing ranging from 5 to 40 GHz, is successfully generated.