Nuran Dogru, J Phys Chem Biophys 2013, 3:5
http://dx.doi.org/10.4172/2161-0398.S1.002

OMICS Group Conferences
Accelerating Scientific Discovery

International Conference and Exhibition on
Lasers, Optics & Photonics
October 07-09, 2013 Hilton San Antonio Airport, TX, USA

Design of sinusoidal chirped fiber Bragg grating for mode-locked hybrid soliton pulse source

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In this paper, sinusoidal chirped Gaussian apodized fiber Bragg grating (FBG) utilized in mode-locked hybrid soliton pulse source (HSPS) is reported for the first time using time domain solution of coupled wave equations and rate equations. The model consists of a multi-quantum well laser, an optical fiber, and a FBG. The one facet of diode is high reflectivity (HR) coated for improved cavity Q and the other is antireflection coated (AR) to allow coupling to the external cavity and suppress Fabry Perot modes. The output power is measured through the grating. Time-domain solution of the coupled mode equations is performed using a piecewise-uniform approach. The carrier density is determined from a conventional rate equation with the assumption that the gain is linearly dependent on the carrier concentration. Numerical results indicated that the sinusoidal chirped FBG provides a wider bandwidth by adjusting the reversion coefficient or chirp rate. A wider bandwidth is also achieved with this grating even if FBG length is short. Furthermore, it is also shown that HSPS utilized sinusoidal chirped FBG produces shorter pulses giving in the 25 to 72 ps range whereas it ranges to 31 to 97 ps for linearly chirped tanh apodized and 30 to 80 ps for linearly chirped Gaussian apodized as well as increasing the mode-locking frequency range. As a result, mode-locking performance of HSPS with sinusoidal chirped gratings is better than that of linearly chirped gratings.

Biography

Nuran Dogru received the B.Sc., M.Sc., and Ph.D. degrees from the Electrical and Electronics Engineering Department, University of Gaziantep, Gaziantep, Turkey in 1994, 1997 and 2003 respectively. She was involved in research on actively mode-locked lasers, intensity modulation of external cavity lasers and relative intensity noise of mode-locked hybrid soliton pulse sources where fiber Bragg gratings are used as external cavity. She is currently with the Department of Electrical and Electronics Engineering, University of Gaziantep.

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