Semiconductor mode-locked pulse generator with intra-cavity high-finesse etalon

Ryoichi Nakamoto, Takashi Ohira[(a)] and Yoshiyasu Ueno

Department of Electronic Engineering, University of Electro-Communications, Chofu, Tokyo

(a) *Present address: Fujitsu Access, Ltd., Kanagawa, Japan*

e-mail: nakamoto@ultrafast.ee.uec.ac.jp

Ultrashort pulses with repetition rate over 40 GHz are needful for the optical time-division multiplexing (OTDM), which operate over 160 Gb/s in the near future. The delayed interferometer signal converter (DISC) [1] loop type pulse generator (Fig. 1) has the advantages in the long-term stability, large-scale integration in the near future [2]. In this scheme, the pulse repetition rate and the pulsewidth are determined by the etalon free spectral range (FSR) and delay time in the Mach-Zehnder interferometer, respectively.

Previously, we demonstrated pulse generation at repetition rate = 40 GHz, pulse width = 2 ps with this scheme [3]. However, these results suffered from multi mode oscillation preventing the stabilization of repetition rate, so we aim at the generation of high quality pulses with single mode oscillation. One of the ways of removing multimode oscillation is the use of high finesse etalons. Fig. 2 shows the measured number of longitudinal modes as a function of the etalon bandwidth. We can extrapolate that oscillation will be single mode for a bandwidth about 400 MHz (finesse 100). Fig. 3 shows the measured transmittance of an etalon with finesse 220 (3dB bandwidth = 180 MHz), which should result in single mode operation when used in the DISC-loop.

In the symposium, we will present some results with using the high finesse etalons.

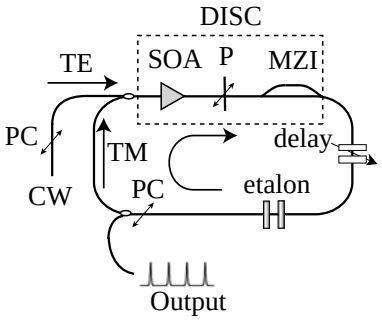

Fig. 1. DISC-loop type pulse generator
CW: continues wave
PC: polarization controller
SOA: semiconductor optical amplifier
P: polarizer
MZI: Mach-Zehnder interferometer

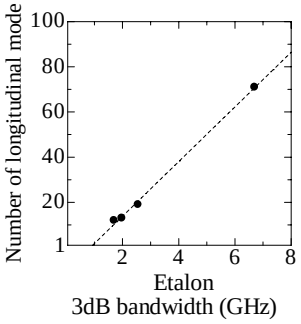

Fig. 2. Number of longitudinal mode on pulse generation (40GHz, 5ps)
dash line: approximated curve

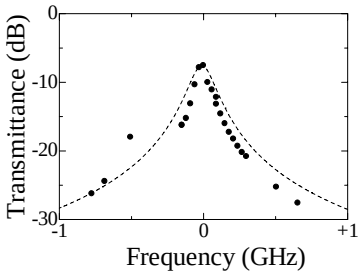

Fig. 3. Transmittance of high finesse etalon
dot: Measured point around 1550 nm (192 THz)
dash line: fitting curve
3dB band width = 180 MHz, finesse = 220

References

1. Y. Ueno et al., IEEE Photonics Technol. Lett. vol. 10, no. 3, pp. 346-348, March 1998
2. Y. Ueno et al., Appl. Phys. Lett., vol. 79, no. 16, pp. 2520-2522, Oct. 2001.
3. R. Suzuki et al., CLEO/QELS 2006, paper no. CMG5, May 21-26, 2006.
4. R. Suzuki "40GHz mode locked pulse generation using all optical polarization conversion by semiconductor," master thesis, March 2006.