We are studying on optical communications and photonics in order to realizing comfortable human society. Large capacity tele-communications and ubiquitous sensor networks can serve comfortableness in lives, because the technologies can make barrier-less interfaces among humans, or between human and terminal machineries. Many kinds of idea for the technologies are proposed in our grope and evaluated theoretically and experimentally by ourselves. Some of detailed our techniques are introduced as follows.

1. Optical single sideband (SSB) modulation for Long-haul fiber transmission:
Optical SSB modulation signal has only one sideband, while conventional optical modulation techniques have two sidebands with the same shape around optical carrier frequency. Then the optical SSB has an advantage of signal bandwidth. Fig. 1 shows the optical SSB spectrum. The details can be given by some publications of (1) K. Takano et al., “Performance analysis of optical single sideband modulation based on Mach-Zehnder interferometers and its dispersive fiber transmission,” IEICE Trans. on Commun. Vol. E88-B, No. 5, pp.1994-2003, May 2005, (2) K. Takano et al, “Experimental demonstration of optically phase-shifted SSB modulation with fiber-based optical Hilbert transformers,” OFC/NFOEC2007, JThA48, Anaheim, CA, USA, March. 25-29, 2007.

2. Functional photonic circuits based on photonic crystals: Bragg reflection that is caused periodical refractive index arrangements can open up the novel control of light, while many conventional optical devices were based on the total internal reflection. Fig. 2 shows wavelength demultiplexers, for example of our functional idea. The details can be given by some publications of (3) K. Takano et al., “Frequency analysis of wavelength

3. Functional photonic circuits using optical amplifiers: Optical amplifiers have large potential to make advanced optical functions, because the optical amplifiers break restriction of optical loss. Fig. 3 shows the optical pulsed frequency sweepers with our envelope stabilizing technologies. The details can be given by some publications of (4) K. Takano et al., “Reduction of power fluctuation in pulsed lightwave frequency sweepers with SOA following EDFA," IEEE Photon. Technol. Lett., Vol. 19, No. 7, pp. 525-527, April 2007.

4. Optical modulation techniques for both analogue and digital signals: Collection of sensor signals from broad area needs novel optical modulation techniques free from signal format. We have been proposed optical modulation techniques utilizing wavelengths, pulse timing, and time duration. The details can be given by some publications of (5) K. Takano et al., “Transmission bandwidth expansion of SI-POF using WDM-pulse-position modulations," The 8th Optoelectronics and Communications Conference (OECC2003), 15D1-3, pp.550-551, Shanghai, China, Oct., 2003.