Chapter 4
Conclusions

We have accomplished the design of the dispersion-compensated interleaver model by simulation. The technologies, including the delay line, the optimization of the angles of the half-wave plates, and the dispersion-compensated design, are in hand clearly. Therefore, we can design the appropriate interleaver to meet the requirements of the each network system. For example, an L-2L design has already sufficed for the 10-Gbit/s metro network system, and an L-2L-2L design is needed in the 40-Gbit/s system. According to the comparisons, the pass band, insertion loss, the size, and the cost are all traded off against each other. In this study, the L-2L-2L was chosen in all system simulation, because it can be efficiently applied to the 40-Gbit/s systems as mention before.

In the optimization of the design, it successfully creates the L-2L-2L interleaver including the -0.5dB bandwidth of 0.72*df (channel spacing) and the ripple of 0.0049 dB. However, a Monte-Carlo simulation of manufacturing imprecision was conducted to estimate the tolerance of design. The most practical condition is considered, such as the Sellmeier equation and the temperature compensation [4.1], in the model of simulation in order to be close to real experiment,.

In another topic, 8 dispersion-compensating interleaver pairs are cascaded for metro add/drop applications. We have successfully created a new interleaver module on the platform of the commercial simulation tools (VPI transmission Maker) and constructed the pint-to-pint DWDM add/drop system. By analyzing the different coding signal and comparing the different data rate, the system performance is shown. In the 10-Gb/s system, the average Q-factor of 32 channels is always higher than expected value (Q=16.9dB) due to the small bandwidth of the signal. But in the 20-Gb/s system, the degradation of the system performance follows with the increasing of the number of the cascading interleaver pairs because of the higher bandwidth. The 40-Gb/s signal in NRZ format is transmitted through the 8 interleaver pairs, the average Q-factor is already little upper than expected value. The reason maybe results from the more nonlinearity. The simulation result proofs the reliability of the transmission for the 40-Gb/s signal. In another case, the Q-factor of the 40-Gb/s system in RZ format is 15.7 dB because of the more out-of band crosstalk. In addition, it is sure that the interleaver pairs without dispersion compensation can not be used in 40-Gb/s system.

Of course, the basic construction of the system simulation is considered with many ideal conditions, and it is convenient to modify to the more practical condition. The unexpectedly unstable factors, such as environmental vibrations, are unavoidable in real experiments. Setting higher target (Q=16.9) is necessary in simulation before experimenting with time and money. By using the simulation tools, we can catch the better parameters from the optimum process to make experiment easier.

References

[4.1] J. Chen, "*Dispersion-Compensating Optical Digital Filters for 40 Gb/s Metro Add/Drop Applications,*" Photonics Technology Letters, IEEE, Volume: 16, Issue: 5, May 2004, Pages:1310 – 1312.