CHAPTER 6
CONCLUSION AND FUTURE WORK

6.1 Conclusion

In this thesis, optical sensor used fiber loop ring-down (FLRD) as physical sensor (strain sensor) has been studied. The system with 10 m length of fiber loop and split ratio of the coupler 0.5:99.5 has trip time ($t_r$) 48.67 ns and ring-down time ($\tau_0$) 1.52 $\mu$s. Its mean that, the light pulse travel the loop 31 times during one ring-down times. Detection sensitivity of that system is 31 times better than that obtained by a round of interaction of the sensor. Detection sensitivity of FLRD system is not affected by the intensity of the light source.

Strain sensing comparison between single and multimode fibers using optical low coherence interferometry has been demonstrated. Two stages Mach-Zehnder interferometry with sensing arm in the first stage and analyzing parts with stepper motor in the second stage used for strain sensing structure has been completed. Motor stepper setting up with movement distance 20 nm in every step and the velocity 10000 step/s. Strain given on the fiber is $22.22 \mu\varepsilon$ in 9 cm of original length and it is applied several times. According to experimental result, the sensitivity of multimode fiber is higher than single mode fiber, but multimode is unstable and high fluctuation that cause could not measure strain in many point. Repeatability of both single and multimode are uncertain and the system needs to be evaluated. Interferogram distance of MMF is higher than SMF, that indicated the loss transmission and the noise of multimode fiber is higher.

6.2 Future Work

In this thesis, fiber loop ring-down systems are studied as strain sensor. The calculation data get from the reference show that ring-down time ($\tau_0$) is 1.52 $\mu$s. Data experimental of ring-down approach show high noise and the ring-down see unclear. For future wok, the parameter of every device (sensitivity and resolution) is necessary to considered.
Although low coherence MZ interferometry as strain sensor with single and multimode fiber in sensing arm has been demonstrated, further understanding for structure parameter on performance need to be proposed. In recent thesis, sensitivity of sensor system is around $10^{-1} \, \text{μm/με}$. This sensitivity can be enhanced by increasing length of fiber. And for uncertain of the output performance, evaluation of the system needs to be improved by increasing repetition number of measurement. In the future, low coherence interferometry for sensing other parameters such as temperature and pressure should be proposed.