Laser Feedback Interferometry is based on the self-mixing effect [1]. When light emitted from a laser reflects in a target and is reinjected into its cavity, the optical parameters of the laser change providing information about the target. As a result, LFI techniques with semiconductor lasers are widely used because they offer simple and low cost set-ups [2]. The aim of this thesis was to acknowledge this effect and to develop a new LFI technique for fluid sensing related applications, capable of detecting and measuring bubbles travelling through a microfluidic channel. We have demonstrated that a real-time bubble detector with a high sensitivity and accuracy is possible to implement with a simple set-up and, additionally, the bubble’s volume can also be estimated with accuracy.

**REFERENCES**