Chapter 7

Discussion and Future Scope

The work during the course of the thesis was aimed at providing optical solutions to few issues arising in the areas of metrology. Efforts have been made towards designing and developing optical systems which are simple, compact and especially inexpensive. The effectiveness of using laser speckle in various imaging and measurement modalities has been explored. The work in the thesis can broadly be divided into three sections based of the technique with which laser speckles are used and their applications as (1) Laser Speckles with correlations algorithms (2) Laser speckles which lensless Fourier transform digital holography technique (3) Laser speckle with iterative phase retrieval technique.

Laser Speckle correlation algorithm is employed to measure optical and physical quantities by tracking the changes in the speckle pattern. But this technique does not provide phase images and work only on computing the correlation coefficient values. This analysis can be extended by engaging various other statistical algorithms so that correlation can be utilized to obtain useful information. One such approach is to apply Fractal analysis which is considered very crucial while describing natural phenomena. In the case of lensless Fourier transform digital holography, the object information was converted to speckle pattern to facilitate the CCD to collect information from a larger part of the sample. This technique provided the phase data since it involves a reference beam owing to which the principles of digital holography are applied. Iterative phase retrieval approach was explored for performing contouring using two wavelengths. The object beam was converted into speckle field to convert the low spatial frequency into a higher spatial frequency by enhancing the change in recorded intensity pattern between two successive planes. Thus, to summarize the work in the thesis, the laser speckles are employed with various optical techniques to make the measurement and imaging systems simple with better ergonomics and low-cost.

The future plan is to undertake the work on remote sensing of hemodynamics in main blood arteries and in brain by employing a patented approach which is non-

invasive and works on the technique of observing the movement of the secondary speckle patterns generated on the top of the target under investigation when it is illuminated by a spot of laser beam.