# NOVEL INTERFEROMETRIC TECHNIQUES IN PROFILOMETRY AND SPECTROMETRY

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# Abstract

The work in this thesis is in the fields of profilometry and Fourier transform spectrometry.

Deformation measurement of diffuse objects by phase stepping was achieved by thermal frequency drift in a HeNe laser. The system was easy to construct, required no specialised components, was immune to the effects of piezo-actuator hysteresis, and was capable of producing phase maps in which noise was less than $1/20\lambda$.

A method was proposed for measuring absolute surface profile by scanning frequency over the range of a white light source. The coincidence technique of coherence radar was used to measure surface profiles in three dimensions to micron accuracy. Spatial techniques were developed to process the large data set quickly and efficiently.

A novel Fourier transform spectrometer was developed to measure the spectrum of narrowband light sources. Heterodyning techniques gave a resolution of $0.01nm$ with a free spectral range of $\approx 2.5nm$. The Sagnac common path design afforded immunity to vibration. The mode structure and mode hopping characteristics of a typical laser diode were measured as a function of diode injection current.

An improved Fourier transform spectrometer was developed. Based on a Michelson interferometer. The instrument could resolve to $0.013nm$ over a $\approx 3nm$ free spectral range. Instrument operation was simplified and functionality was extended to non point sources.

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CHEERS

TINA

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