Title:	iLens Interferometer Probing Micro-scale Systems
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Abstract:	Studying light and matter interaction using optical techniques happens to be of great importance in various science and technological fields. This is because the field of optics offers a wide range of applications as a non-contact metrological tool. It is implemented in devices ranging from optical profilometers, interferometers, spectro- graphs, temperature sensors etc. One of its major techniques is optical interferometry, which has emerged as a crucial tool for measuring small displacements and surface features with extraordinary precision and speed. This thesis presents an interferometry based optical metrological technique used to carry out sensitive measurements of thermo-mechanical dynamics experienced by microscale objects. The experimental method presented here for optically probing thermo-mechanical strain in fibre-like microscale systems is demonstrated on a thin silver (Ag) wire specimen and on a human scalp-hair specimen. While focused laser beams are used to irradiate these specimens, central technique to the complete experimental system is the iLens interferometer. Studies of temporal profile of dynamic interference fringes are carried out using the superposition principle of light waves. Theoretical and com- putational analysis of the interferometric fringes led to the development of convenient computer programs to extract explicit dynamical information out of the system. Fur- ther modifications in the interferometric probing system are introduced to enable the study of additional physical properties of the microscale systems, like response time etc. Optical interferometry provides sensitive metrological capabilities and can be ap- plied to various other science and engineering fields, for instance, in biology and medicine to measure subcellular components, making use of its non-invasive nature of application. Also, it finds a variety of uses in mechanical testings of microelec- tromechanical systems (MEMS) and materials such as thin films, micro-tubes, cellular biomaterials etc. As part of the future scope of the research presented in this thesis, it includes a few experiments to measure the mechanical response delay of thin mi- crofibres. Results of these experiments are left without much of a rigorous analysis since these were meant to test a few of the wide range of possible applications towards which this research work can be extended. Application of the experimental method presented in this thesis can also be further extended to test many ultra-thin natural biopolymers exhibiting high mechanical advantages that can have a vast variety of applications, such as in designing components of micromachines.
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