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Tesis:

"ANALYSIS AND CORRECTION OF THE ADDITIVE PHASE EFFECT GENERATED BY POWER CHANGE IN A MACH-ZEHNDER INTERFEROMETER INTEGRATED TO AN OPTICAL TRAP"

Resumen:

Immersion microscope objectives stand out for their large numerical aperture, which improves the optical resolution of imaging systems such as those used in microscopic interferometry. At the same time, these objectives make it possible to increase the gradient forces of a beam focused through them, thus forming an Optical Trap (OT). However, many studies on microscopic interferometry neglect the contributions of different optical materials of the system that are also exposed to laser radiation. In this work, a Mach-Zehnder interferometer and an optical trap, that share several components (including the same oil immersion objective), were coupled. Here an individual analysis of the media through which light travels and which are present in the experimental setup is carried out to determine their optical contributions to the experimental performance and results. Also, it is reported the response of interferometer (phase shifting in interference fringes) to a progressive increasing in the optical trap laser power, while the interferometer laser power remains constant. When a change in laser power is applied, the oil temperature changes, and consequently, so does its refractive index and volume, which in turn causes a phase shifting on the transmitted wavefront. The study here presented suggests that the refractive index variations in the immersion oil affect interferograms because they will then exhibit an additive phase term that must be considered in that final measurement. Moreover, the optical trap geometry will also change with the power increase. In order to make a proper digital correction, the laser characteristics and the oil response to its exposure must be known. In the second part of this thesis, an optical phase analysis is applied in the three-dimensional measurement of the damage produced by the optical trap on a paint film so that the digital correction can be made later.