Advisor: **Dr. Manuel Humberto De la Torre Ibarra**

Committee Members:

Dr. Claudio Frausto Reyes
(Evaluador Interno, Presidente)

Dr. Jorge Mauricio Flores Moreno
(Evaluador Interno, Secretario)

Dra. María del Socorro Hernández Montes
(Evaluadora Interna, Vocal)

Thesis: **"STUDIES OF HYDRODYNAMIC WITH T-DHI AND BONE MECHANICAL INTEGRITY USING DHI AND FD-OCT"**

Summary:

Optical metrology encompasses many methods that use light to analyze and quantify the properties of diverse materials and their applications. Interferometric-based techniques are part of these methods and offer non-invasive, remote measurement capabilities with a high-resolution material inspection. They are categorized as superficial or internal inspections from opaque objects and in transmission for transparent media.

The first study involves the transmission Digital Holographic Interferometry (t-DHI) method to measure fluid dynamics inside a scale water tunnel designed as a simile of a wind tunnel. The water tunnel has a transparent chamber where the optical system observes the hydrodynamics from the water and a sample. As proof of principle, three tests are presented to validate the similarity of the system with an aerodynamic test. For this purpose, a scale model car magnetically placed inside the chamber is tested to detect its drag due to a laminar flow moving in the tunnel. The results prove that t-DHI has the potential to be used as an alternative to traditional wind tunnels.

In the second study, a dual configuration using Digital Holographic Interferometry (DHI) and Fourier Domain Optical Coherence Tomography (FD-OCT) simultaneously explores the mechanical change of mice femoral bones stored in different solutions. The influence of the storage media on the viscoelastic properties of the tissue is analyzed by employing a three-point bending test. Three bone groups are prepared, a control with fresh post-mortem samples. The second and third groups use saline and formaldehyde solutions as storage media. The high sensitivity of the optical techniques makes it possible to observe changes in the anisotropy of the samples. As a comparison, Raman spectroscopy analyses the three bone groups to prove that the preservation media does not affect a single-point inspection as the full-field one.