

Asesor: Dr. Bernardino Barrientos García

Sinodales: Dr. Luis Mariano Cerca Martínez
(Sinodal Externo – Centro de Geociencias UNAM, Secretario)

Dr. Carlos Pérez López
(Sinodal Interno, Vocal)

Dr. Bernardino Barrientos García
(Asesor de Tesis, Presidente)

Tesis: "MEASUREMENT OF 3D DEFORMATION IN TRANSIENT PHENOMENA"

Resumen:

Three-dimensional deformation of objects is an important topic when evaluation of performance of mechanical systems is of interest. Deformation can be measured by classical methods, by using strain gauges, for example. However, in these types of methods, it is necessary that the sensor is in contact with the object, and generally they are point-wise. Optical methods can deal with those limitations, and even add further abilities such as automatization. Among optical methods, fringe projection (FP) and digital image correlation (DIC) have shown potentiality to be used in industrial environments. However, FP can only yield the out-of-plane component of displacement and DIC the two in-plane components of displacement. As shown in previous works, combination of both techniques, called here FP-DIC, allows us to obtain the three components of displacement, but separated in time. In this work, we present a variation of FP-DIC that enables us to use FP and DIC simultaneously. As a consequence, dynamic events can be fully analyzed. In addition to show simultaneity, the technique has been extended as to cover objects that are not neutral in color, as generally assumed, but multi-colored, which is a more realistic situation in industry. The optimization of the light source for multi-colored objects is examined by means of a contrast analysis. Additionally, the objects under analysis may even present relatively high dynamic range of intensity levels. This latter feature is dealt with by incorporating an independent light source for DIC (an additional advantage is the analysis of surfaces that may contain a large range of values of roughness). Feasibility of the technique is shown through two application examples: the analysis of an avalanche and the compression of a layered model, both in the field of geology.