DFA Dirección de Formación Académica

CENTRO DE INVESTIGACIONES EN OPTICA, A.C.

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Thesis: **"LOCAL CURVATURE CALCULATION AND ITS USE IN IMPROVED TOPOGRAPHIC MAPS"**

Summary:

In this thesis, we develop the proper mathematical tools to calculate the local curvature over any type of surface including the cornea of a human eye. The calculus of local curvature of a curve described on a plane and the common methods in ophthalmology are used to calculate and graph the curvature or power maps. Then, we extend the calculus of local curvature to surfaces, and we propose a general equation to calculate the curvature over any hypothetical mathematical surface. We connect the general equation with cases of the calculus of curvature and we show how to obtain any case from the general curvature equation. We transform the general curvature equation to the Euler equation, this form is useful to describe the Cassini ovals, which can be used to represent in a geometric manner all the cases of curvature description used in the fields of ophthalmology, tribology, and in topography. We propose a new and interesting manner to graph the common representation of a wavefront utilizing the Cassini ovals over a circular pupil. Euler equation uses the principal curvatures and the angle to graph its polar form. This approach improves the curvature description and gives more information than those of the classical color-coded maps. Examples of Cassini maps are displayed to different wavefront representations to validate the advantages over color-coded maps.