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On the structure of the local ridges of the equipotential surfaces of the Earth's gravity field.

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Generally given a smooth surface, a *ridge* is a curve such that at each of its points, the maximum (minimum) principal curvature has an extremum along its curvature line. Ridges are curves of *extremal* curvature and therefore encode important information used in surface analysis or segmentation. We are interested in the case where the surface of interest is an equipotential surface of the earth's gravity field, under the assumption that there are no umbilical points, i.e. points at which both principal curvatures are equal, and every tangent vector is a principal direction. In this case, if P is an elliptic point of a specific ridge, and the maximum principal curvature takes a supreme value then the angle between the vertical line at P and the corresponding vertical line at a neighboring point P' along the principal direction at distance ds apart, is a supreme. Furthermore, if the point P lies on the geoid then the corresponding differential geoid undulation $dN_{PP'}$ is also a supreme. In this paper, we carried out a study of the local geoid ridges with the help of algebraic equations. At first, we derived the condition which must be satisfied in order that a point P on an equipotential surface of the earth's gravity field lies on a local ridge. Then we outline the necessary equations that allow determining the direction of the ridge at each of its points. We show that locating and reporting them requires manipulating third, forth and fifth order partial derivatives of the gravitational potential — whence imposes numerical difficulties.