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Sensitivity analysis and stability charts for uniform slopes computed via the MLD methods in the frame of the limit equilibrium theory

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Stability charts represent a graphical solution to derive the safety factor (F) without incurring the difficulties of mathematical and numerical methods for the analysis of slope stability, widely used in the engineering field: employed in a preliminary phase of analysis, the consultation of charts allows one to determine the approximate equilibrium conditions.

The first to develop this method is Taylor (1948) who made them of common use: his stability charts are the relationships between the height and the inclination of a schematic slope, for particular types of failure surface (toe circle, circle slope, and midpoint circle) and for different values of friction angle. Thereafter the charts have become more detailed and complete (Janbu, 1968), thanks to the continuous introduction of new methods, like the limit equilibrium method (LEM), the limit analysis method and the finite element method (FEM).

The aim of this work is to compare sets of stability charts found in literature (Michalowski, 1997; 2002; Li et alii, 2009; Steward et alii, 2011; Zhang et alii, 2011) with new charts obtained with the results obtained by means of the method of minimum lithostatic deviation (MLD) introduced by Tinti and Manucci (2006 and 2008) for 2D problems: the slope is a homogenous body and we analyze different cases, by varying the geometry (e.g. the slope angle and height), the geotechnical parameters (such as cohesion and angle of friction), the pore pressure and the external loads (as seismic or hydrostatic loadings) treated as quasi-static forcing.