ABSTRACT

Well Deviation Survey Calculations
Curvature Method

This paper provides a comprehensive mathematical description for the curvature method formulation which is probably the most accurate method for well deviation survey calculations but complex and requires knowledge of calculus and trigonometry.

The well path is determined by measuring the **geographical coordinates** (i,a,m) of survey points along the well trajectory, where (i) and (a) are the inclination and the azimuth angles expressed in degrees and (m) is the measured depth expressed in feet. Then, the **geological coordinates** (e,n,v) are calculated, where (e) and (n) are the easting and northing horizontal displacements and (v) is the true vertical depth expressed in feet.

In this method, the **total rate of curvature** (K) between two successive survey points, expressed in radian per foot, is simplified into two factors (K_i) and (K_a) related to the variation of the inclination and the azimuth angles. These calculated factors are used in calculation of the **increments in geological coordinates** $(\Delta e,\Delta n,\Delta v)$ between two successive survey points.

Given a starting survey point called **tie-in** point where both **geographical coordinates** (i_1,a_1,m_1) and **geological coordinates** (e_1,n_1,v_1) are defined**, the geological coordinates** for the next survey point (e_2,n_2,v_2) are calculated using the calculated increments. Additionally, the **Dog-Leg severity** (K_d), expressed in degrees per 100 feet is also calculated. The calculation procedure is repeated for all survey points.

The paper includes a powerful **FORTRAN** program called **DSCM** which can be used to check historical calculation results for problematic wells and to verify doubtful results provided by service companies. The program is easy to understand and to maintain on any platform.

The output results file consists of seven columns (m,i,a,v,n,e,K_d) representing measured and calculated coordinates and Dog-Leg severity.

The first line of the output file, containing the values of the **tie-in** point, represents with the first three columns $(m,i,a,)$, the input data file.

Note: This abstract and the detailed paper were prepared in order to be published as an SPE paper. Unfortunately, this did not happen before I was retired on 2006. Therefore, I publish it on my site in order to make it available for the next generation of Reservoir and Drilling Engineers worldwide.

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