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Direct Signal Analysis (DSA) Applied to the Identification of Magnetic Components from IRM curves

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Isothermal Remanent Magnetization (IRM) curves are analyzed here using an alternative method based on a Direct Signal Analysis (DSA) in order to identify the number and type of magnetic components in a sample. According to this method, the IRM curve is described by the sum of N elementary curves (modeled using the expression proposed by Robertson and France (1994)) whose medium coercivities vary in the interval of the measured magnetic field divided in N bins. Initially, all the bins contribute equally to the IRM curve. The computer program, based on the Levenberg-Marquardt algorithm, returns a spectral histogram whose heights are the adjusted contributions of each elementary process or bin to the experimental curve. It is important to notice that N is not the number of magnetic minerals present in the sample, but the number of bars of the resulting spectral histogram. This value is always greater than the expected number of mineral components (values between 10 and 30 have been tested) and in some extent depends on the wanted resolution for the histogram. From the spectral histogram, the number of main contributions, their widths and medium coercivities, associated with the number and type of magnetic minerals present in the sample, can be obtained. The areas of each main contribution allow calculating the relative proportion of the minerals. With this method, no a priori assumption about the number or type of mineral components has to be made. Also no additional information regarding the experimental curve has to be provided. The program was tested with computer generated curves with increasing degree of complexity, identifying single or multiple magnetic mineral contributions according to the case. We have also analyzed experimental curves obtained from non-consolidated samples from oil wells where the

magnetic minerals were identified by other means.