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The TENSOR program for paleostress reconstruction: examples from the east African and the Baikal rift zones

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The program TENSOR (Quick Basic for DOS) allows to re-construct the four parameters of the reduced paleostress tensor (stress axis orientation and ratio) from fault slip data and earthquake focal mechanisms, using an improved version of the Right Dihedron method, and a dynamic rotational optimi-sation procedure which a.o. minimize the observed slip - computed shear mean deviation. Because the data sets are usually composite, with inhomogeneous sets or polyphase sets of brittle structures, emphasis is given to interactive procedu-res for data selection and rotation, graphical representation, tensor estimation and optimisation, statistics and data base.

As a test for the efficiency, synthetic data sets were generated by application of given stress tensors on a regular grid of reference planes, and taking slip directions and sense as indicated by the computed shears on reference planes. Working with these synthetic sets shows that the improved Right Dihedron method returns the correct tensor parameters (including stress ratio), when the data set is complete and symmetrical. In the case of incomplete and asymmetrical data set, the value of the stress ratio is more approximate, and further optimisation by dynamic rotation is necessary. Using the dynamic rotational optimisation, even a highly incomplete and asymmetrical data set gives back the original tensor. This means that a few slip data extracted from an homogeneous given fault population still bear the full information over the stress conditions which have caused them to slip.

This method has been successfully applied to highly deformed polyphase zones in the east African and Baikal rifts, where Precambrian to Paleozoic structural anisotropies have been reactivated during Mesozoic and Cenozoic rifting.