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Effect of packing density on strain estimation by Fry method

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Fry method is a graphical technique that uses relative movement of material points, typically the grain centres or centroids, and yields the finite strain ellipse as the central vacancy of a point distribution. Application of the Fry method assumes an anticlustered and isotropic grain centre distribution in undistorted samples. This assumption is, however, difficult to test in practice. As an alternative, the sedimentological degree of sorting is routinely used as an approximation for the degree of clustering and anisotropy. The effect of the sorting on the Fry method has already been explored by earlier workers. This study tests the effect of the tightness of packing, the packing density%, which equals to the ratio% of the area occupied by all the grains and the total area of the sample. A practical advantage of using the degree of sorting or the packing density% is that these parameters, unlike the degree of clustering or anisotropy, do not vary during a constant volume homogeneous distortion.

Using the computer graphics simulations and the programming, we approach the issue of packing density in four steps; (i) generation of several sets of random point distributions such that each set has same degree of sorting but differs from the other sets with respect to the packing density%, (ii) two-dimensional homogeneous distortion of each point set by various known strain ratios and orientation, (iii) estimation of strain in each distorted point set by the Fry method, and, (iv) error estimation by comparing the known strain and those given by the Fry method.

Both the absolute errors and the relative root mean squared errors give consistent results. For a given degree of sorting, the Fry method gives better results in the samples having greater than 30% packing density. This is because the grain centre distributions show stronger clustering and a greater degree of anisotropy with the decrease in the packing density. As compared to the degree of sorting alone, a combination of the degree of sorting and the packing density% is more useful proxy for testing the degree of anisotropy and clustering in a point distribution.