Distances defined for the solutions of stress tensor inversion and residual misfit angles

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Stress tensor inversion determines an optimal stress tensor for a set of fault-slip data or earthquake focal-mechanism data. Here, we firstly discuss the relationship between the parameters indicating the similarity or dissimilarity between the tensors, i.e., Michael's (1987) similarity measure M and Orife and Lisle's (2003) stress difference D. Secondly, we introduce one more dissimilarity measure, angular stress distance Theta. It is shown that there is a one-to-one correspondence between the parameters from D, M and Theta. In this respect, they are qualitatively equivalent. Namely, the tensors are represented by points on the surface of the unit sphere in a five-dimensional space, and D is the Euclidean distance between the points (Sato and Yamaji, 2006). Theta is defined as the great-circle distance for them. It is demonstrated that M equal the cosine of this distance.

However, it is shown that the mean of the residual angles between the theoretical and observed slip directions on the fault-planes equals the angular stress distance between the optimal and other stresses, the latter of which represent the perturbations in the stress field to be determined or measurement errors. Consequently, the mean can be used as a measure to indicate the quality of the optimal solution.