APPLICATIONS OF A HYBRID GENETIC ALGORITHM TO INVERSION FOR SEISMIC ANISOTROPY

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Seismic wave propagation in anisotropic media is a non-linear phenomenon which presents difficulties for any prospective inversion scheme with singularities preventing the direct use of linearized inversion schemes. Further complications arise because in general the phase velocity direction deviates from the group velocity direction leading to cuspidal behaviour for strong anisotropy. An inversion scheme is required which is both non-linear and global. This is achieved by using an optimization procedure based upon genetic algorithms (GAs). We illustrate the application of this technique to inversion for seismic anisotropy from a selection of field and laboratory measurements. qS1 polarization directions and time-delays are inverted for field data from an azimuthal VSP shot at the Conoco borehole test facility. The results show the observed behaviour can be interpreted in terms of a sub-vertical crack system, and reveal a line singularity which strongly constrains the solution. Laboratory measurements taken from past work estimating qP group velocities with a range of directions over a hemisphere are consistent with previous inversions and can be interpreted as aligned crack systems consistent with a priori data.