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Computer program modifications of Open-File Report 82-1065: A comprehensive system for interpreting seismic-refraction and arrival-time data using interactive computer methods

by

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ABSTRACT

The computer programs published in Open-File Report 82-1065, A comprehensive system for interpreting seismic-refraction arrival-time data using interactive computer methods (Ackermann, Pankratz, and Dansereau, 1982), have been modified to run on a mini-computer. The new version uses approximately 1/10 of the memory of the initial version, is more efficient and gives the same results.

MODIFIED PROGRAMS

The computer programs of the initial report (Ackermann, Pankratz, and Dansereau, 1982) were written for a large virtual-memory computer. They have been modified to run on a mini computer (a Digital Equipment Corporation (DEC) PDP 11-34A) in the DEC fortran IV-plus language.

The algorithms for the new set of programs are significantly different from the initial version. They run much more efficiently and use roughly an order of magnitude less memory. All of the test problems of the initial report have been rerun and result in essentially identical answers. A tape copy of the new version can be obtained upon request from the authors by sending a blank tape. Their address is U.S. Geological Survey, Denver Federal Center MS 964, Denver CO 80225.

Program execution is somewhat different from the old version and is explained in a file named DOCUMENT.FTN. All of the essential modules (i.e., mainline programs and subprograms) are documented in this file. The programs furnished on tape are in the same order as listed in the file DOCUMENT.FTN, which is the first file on tape.

The normal sequence for processing refraction data using these programs is given below. It is assumed that the seismic lines are straight.

1. Determine a name FN for the line (8 characters or less).
2. Determine a reference point (distance and altitude) for the line. All distances and altitudes will be with respect to this point.
3. Determine a reference number (k number) for each seismogram.
4. Digitize each seismogram (i.e., determine value of first-arrival time for each trace).
5. Input digitized data into the disk file named FN.0TX, using incremental values of distance (see documentation of program PERP). This may be done using mainline program TXIN. However, it is usually more efficient if digitizing is done on a digitizer and the data automatically input into this file. (Programs for doing this are not included.)
6. Run program PERP for the data in file FN.0TX to change the incremental distance values into actual distance values with respect to the reference point, and to correct for perpendicular offsets of the shotpoints with respect to the seismic line. The corrected values are automatically re-entered into the file FN.0TX.
7. Prepare a time vs. distance (t-x) plot of all the data in file FN.0TX. This is best done using an automatic plotting program. Automatic plotting programs are not included in this package.

8. Approximate the t-x plots with straight line segments, using the principals explained in the section titled manipulating arrival-time curves (Ackermann, Pankratz, and Dansereau, 1982).
9. Digitize the end points of these straight line segments and input their values into disk files FN.T1, FN.T2, . . ., FN.T15, (for example, the data for layer one, the direct ray, are input into FN.T1, for layer two into FN.T2, and so on. See documentation of mainline programs TXIN and TXIO in the file DOCUMENT.FTN). Input may be done using program TXIN. However, it may be more efficient if digitizing is done on a digitizer and the data automatically input into these files.
10. Input surface distances, altitudes, and velocities (i.e., layer one) into disk file FN.MOD, using program MODLIN.
11. Run mainline program RUNCRIT or RECIP to obtain results for layer two. Answers are output into disk files FN.A1, FN.A2, . . ., FN.A15 depending on the layer being computed.
12. Input distances, altitudes and velocities for layer two into disk file FN.MOD using program MODLIN.
13. Run mainline program RAYTRACE, if desired to compare the computed results against the t-x data.

11a., 12a., 13a. Repeat steps 11, 12, and 13 for layer 3.

11b., 12b., 13b. Repeat steps 11, 12, and 13 for layer etc. until all layers are determined.

REFERENCES CITED

Ackermann, H. D., Pankratz, L. W., and Dansereau, D. A., 1982, A comprehensive system for interpreting seismic refraction arrival-time data using interactive computer methods: U.S. Geological Survey Open-File Report 82-1065. 265 p.