1995 CREWES software release

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ABSTRACT

This paper gives a brief overview of the contents of the 1995 CREWES software release.

OVERVIEW

In the course of performing our research, we often write computer programs to test new ideas and to solve new kinds of problems. Our goal is to deliver not only the results of our work in the form of a research report, but also as prototype software. This software release lets sponsors obtain implemented examples of new algorithms. It should be noted that all the code we release is prototype code. Our goal is not to produce polished, commercial software products, but to create test programs. Sponsor companies who wish to use these programs in a production environment are still advised to study the code carefully, understand how it works, and perform a significant amount of testing. Some utility programs are also included in the release.

This document only server to advertise the presence of the software release. Full documentation for the programs is packaged with the software release, on the 1995 CREWES CD. An envelope containing the CD and the full documentation was distributed at the 1995 sponsors meeting at Kananaskis Lodge. Sponsors can request an additional copy of the release by contacting the CREWES Project:

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The software release is also available over the Internet via the CREWES Web page:
URL: http://www.crewes.ucalgary.ca/

CONTENTS OF THE 1995 SOFTWARE RELEASE

Matlab seismic toolbox

This is a collection of single channel seismic processing routines, seismic data input/output and viewing routines written by Dr. Gary Margrave. This toolbox forms the core of a series of Matlab applications which CREWES is developing and will be releasing in subsequent years. This toolbox adds tremendously to the power of the Matlab computing environment, making it an almost ideal platform for the development of new seismic algorithms.

Matlab is a commercial product which provides a computing environment with high performance vector, matrix and visualization functions. The Matlab package is available for most Unix platforms, MS-Windows and Macintosh PC's and even supercomputers. Once code is developed for Matlab, it will run on all Matlab supported platforms.

Matlab implementation of Synth

The Synth program performs PP, PS and SS offset stack synthetic seismogram generation. It is based on raytracing of flat layers using the bisection method for solving the ray parameter. Reflection coefficients are computed using the Zoeppritz formulae of Aki and Richards, as coded by E.S. Krebes. Synthetic seismograms are created by stacking NMO-corrected traces over a range of offsets.

This version is a complete reimplementation in Matlab, with a new raytracing engine by Dr. Gary Margrave, a new user interface by Darren Foltinek, and an interface to the Matlab wavelet editor (below). See (Margrave and Foltinek, 1995) for a complete discussion of this module.

Wavelet editor

This Matlab module, written by Dr. Gary Margrave, allows the creation of numerous types of wavelet (Ricker, Bandpass etc.) with a wide variety of phase and frequency control (center frequency, bandlimited, zero or minimum phase, etc.). These wavelets may be saved or exported to other Matlab seismic tools.

P-S inversion

This program estimates S-wave velocity from P-S seismic data by constrained inversion. Required input are: CCP gathers (conditioned for true amplitude and frequency), a P-wave velocity (can be taken from a P-P inversion) stretched to P-S time, and initial guess S-wave velocity. User defined parameters include scaling of the reflection data, inversion time span and damping factor. This implementation utilizes the ProMAX processing system and was implemented as a ProMAX module by Robert Ferguson and Henry Bland. The algorithm is described in chapter 18 of this research report, (Ferguson and Stewart, 1995).

CSP gather and filters

The CSP gather algorithm (Bancroft et. al., 1995) was first released at the 1994 sponsors meeting. The 1995 version has several changes and improvements, including:

- 3d processing.
- laterally varying velocity field

There is also a CSP filter module, which operates on data in the CSP - equivalent offset domain. This filter module includes:

- Anti-alias filtering
- Tapered dip filter
- $\sqrt{j\omega}$ correction

3-D VSP NMO Correction

3-D VSP NMO correction is a method of correcting the normal moveout traveltimes of a P-P wave 3-D (R)VSP wavefield to the two-way traveltime corresponding to surface seismic. This algorithm, written by Qi Zhang, is implemented as a ProMAX module. See chapter 34 of the 1995 research report (Zhang and Stewart, 1995) for a complete discussion.

3-D VSP binning and mapping

This program first calculates the reflection points for all sources and receivers. A 3-D data cube is defined by the bin size. The data is then mapped into each bin in the data cube by common reflection point. This depth variant binning process was written as a ProMAX module by Qi Zhang. See chapter 34 of the 1995 research report (Zhang and Stewart, 1995).

Landmark colormap translation

The "lmcolormap" program translates landmark colormaps into two other formats: Photon SeisX colormap format, and matlab colormap formats. Written by Henry Bland.

SUMMARY

The CREWES Project software release is provided with the hope that it is an effective means of technology transfer to our sponsors that complements the research report. Please let us know if you have any questions or comments about this or any other software release

REFERENCES

Bancroft, J. C., Wang, S., Geiger, H. D., Foltinek, D. S., 1995, Pre-stack migration by equivalent offsets and CSP gathers:, CREWES Research Report, v. 7, ch. 23

Ferguson, R. J., Stewart, R. R., 1995, Estimating shear-wave velocity logs using P-S seismic inversion:, CREWES Research Report, v. 7, ch. 18

Margrave, G.F. and Foltinek, D.S., Synthetic P-P and P-S cross sections, CREWES Research Report, v. 7, ch. 5