GL03495

Abstracts of papers presented at the Forty-Second Annual International SEG Meeting*

Modification of Finite Difference Codes for Irregular Boundaries

L. E. Alsop

Problems arise from attempts to derive finite difference formulas for the elastic wave equation in media containing irregular boundaries, such as the apex of a wedge. Static problems for such geometries can be treated by the finite element method, a particular version of which is readily adaptable to obtain difference formulas at irregular boundary points. Animation will occur in the form of computer-generated film showing Rayleigh-wave propagation in wedges.

EAEG Presidential Address: How Do We Know We Are Right?

N. A. Anstey

The geophysicist rummages around in his bag of tricks, and produces a section with a flourish—"There you are, fellas, that's the way it is." The geologist takes one cursory glance, and says "No, that can't be right."

The researcher climbs out of his waste-paper basket shouting "Eureka—a new program!" The geologist shakes his head sadly—"That's worse."

So what is *right?* or *better?* or *worse?*

Occasionally the matter is proved, more or less, by the drill. But usually the final test applied is one of *geologic plausibility.*

This is not very satisfactory, since the test is neither objective, nor rigorous, nor quantified.

The time has come to build more validation into our techniques, and we begin to see how to do it.

Estimates of Geothermal Energy Potential

John Banwell and Tsvi Meidav

On a global scale, geothermal energy is emerging as the largest single reserve of energy which, with present technology, shows definite promise of meeting a substantial portion of world needs for an effectively indefinite period. In large-scale development, pollution problems become negligible, rather than aggravating with size. It is also becoming clear, with increasing experience and theoretical study, that existing thermal beauty spots need never be sacrificed to power generation, since geothermal resources on a global scale are not generally associated with surface activity.

Over those parts of the land surface of the earth, where the geothermal gradient is about 30°C/km, the stored thermal energy to a depth of 7.5 km is equivalent to some 26 million tons of oil or 7500 megawatt years per sq km. Depending upon the portion of the land surface characterized by such a gradient, the total stored energy to 7.5 km may vary between ten to one hundred times the most extreme estimates of total world oil, coal, and nuclear fission energy reserves. Hypernormal gradient areas cover another ten percent of the land surface and account for a further comparable amount of energy, but in a more accessible form. Finally, the present-day geothermal fields, many of which are located within these hypernormal areas, have an energy potential equivalent to about 6×10^9 tons of oil per year, which is comparable with estimated total world consumption of primary energy for the year 1978.

Further geothermal development will inevitably move from the present high-temperature shallow reservoir type to the deeper but much more extensive heat preserves of the crust. As this occurs, there will be more opportunities for the direct use of heat in industry and for domestic heating and cooling, leading to higher efficiency and lower costs.

A Proposal for a New Method of Airborne Electromagnetic Mapping

A. Becker and A. K. Sinha

The undesirable effects of the limited conductivity aperture of fixed-frequency, conventional systems may be overcome with the introduction of a device for automatically changing the transmitter frequency in concert with the ground conductivity. The phase of the secondary field appears to be a suitable criterion for operating the decision-making equipment. When this quantity is maintained constant, the operating frequency is directly proportional to the ground resistivity.

A computer simulation and a laboratory scale-model study indicate that such a system is feasible. The results that would be obtained with it in a number of geologic settings compare quite favorably with those that conventional systems can be expected to yield in similar circumstances.

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