

Characterizing Reservoirs by Analyzing Injection and Production Rate Fluctuations

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Characterization of mature field is hindered by the lack of data, particularly pressure data. One type of data--production and injection rates--is nearly always present, and it is the hypothesis of this work that such information can be used to infer properties of reservoirs. This presentation summarizes attempts to validate this hypothesis.

Over several years we've modeled interwell connectivity as regression coefficients (parametric and nonparametric), as linear interactions or weights (as would occur in incompressible flow), and more recently as slightly compressible flow (capacitance model). All of these efforts are successful when applied to simulated data: the techniques are able to extract information about faults, fractures and other forms of heterogeneity between wells. We have also been able to identify causes of negative or nonphysical weights: collinear injection rates, variable bottom hole pressures, and excessive fluid compressibility. These observations constitute a validation of the original hypothesis.

We also applied the methods to several field data sets. These have been successful though less successful than the applications to simulated data. Success or failure is difficult to judge because the truth is poorly known and we are limited to comparisons with geologic or geophysical inference. This problem, which is pervasive in Earth sciences, constitutes a major barrier to the application of the scientific method because it means that hypotheses cannot be easily invalidated.

Biographical Sketch

Larry W. Lake is a professor of the Department of Petroleum and Geosystems Engineering at The University of Texas at Austin. He holds B.S.E and Ph.D. degrees in Chemical Engineering from Arizona State University and Rice University. Dr. Lake has published widely; he is the author or co-author of more than 100 technical papers, the editor of 3 bound volumes and author or co-author of four textbooks. He is a member of the US National Academy of Engineers and has received several awards from the Society of Petroleum Engineers and The University of Texas. He has been at The University of Texas for 27 years prior to which he worked for the Shell Development Co.