DOWNLOAD PDF WELL TEST ANALYSIS JOHN LEE

Chapter 1 : Well Testing - John Lee - PDF Free Download

John Lee holds the Peterson Endowed Chair and is Professor of Petroleum Engineering at Texas A&M U. in College Station, www.nxgvision.com receiving a PhD degree from the Georgia Inst. of Technology in , he worked as a Senior Research Specialist with Exxon Production Research Co. and as a reservoir engineer with Exxon Co. U.S.A. operating districts in south Texas until

Answers to Selected Exercises Nomenclature Bibliography Author Index Subject Index Introduction This textbook explains how to use well pressures and flow rates to evaluate the formation surrounding a tested well. Basic to this discussion is an understanding of the theory of fluid flow in porous media and of pressure-volume-temperature PVT relations for fluid systems of practical interest. This book contains a review of these fundamental concepts, largely in summary formo One major purpose of well testing is to determine the ability of a formation to produce reservoir fluids. A properly designed, executed, and analyzed well test usually can provide information about formation permeability, extent of wellbore damage or stimulation, reservoir pressure, and perhaps reservoir boundaries and heterogeneities. The basic test method is to create a pressure drawdewn in the wellbore; this causes formation fluids to enter the wellbore. If we measure the flow rate and the pressure in the wellbore during production or the pressure during a shut-in period following production, we usually will have sufficient information to characterize the tested well. This book begins with a discussion of basic equations that describe the unsteady-state flow of fluids in porous media. It then moves into discussions of pressure buildup tests; pressure drawdown tests; other flow tests; type-curve analysis; gas well tests; interference and pulse tests; and drillstem and wireline formation tests. Fundamental principIes are emphasized in this discussion, and little effort is made to bring the intended audienceundergraduate petroleum engineering students - to the frontiers of the subject. However, to smooth the expected transition to the Intl. In addition, answers to examples worked out in the text are given in SI units in Appendix F. Chapter 1 Fluid Flow in Porous Media 1. Simple statements of these equations are provided in the text; the more tedious mathematical details are given in Appendix A for the instructor or student who wishes to develop greater understanding. The equations are followed by a discussion of sorne of the most useful solutions to these equations, with emphasis on the exponentialintegral solution describing radial, unsteady-state flow. An appended discussion Appendix B of dimensionless variables may be useful to sorne readers at this point. The chapter concludes with a discussion of the radius-of-investigation concept and of the principIe of superposition. Superposition, illustrated in multiwell infinite reservoirs, is used to simulate simple reservoir boundaries and to simulate variable rate production histories. We naturally make no more simplifying assumptions than are absolutely necessary to obtain simple, useful solutions to equations describing our situation - but we obviously can make no fewer assumptions. This work is only outlined in this chapter; detail is provided in Appendix A and the References. Consider radial flow toward a well in a circular reservoir. This equation is called the diffusivity equation; the term 0. A similar equation can be developed for the radial flow of a nonideal gas: We also have sorne comments on solutions to Eqs. There are four solutions to Eq. Before we discuss these solutions, however, we should summarize the assumptions that were necessary to develop Eq. We will introduce further assumptions to obtain solutions to Eq. The reader unfamiliar with Bessel functions should not be alarmed at this equation. It will not be necessary to use Eq. The most important fact about Eq. It sometimes is caBed the van Everdingen-Hurst constant-terminalrate solution. Because it is exact, it serves as a standard with which we may compare more useful but more approximate solutions. One such approximate solution follows. Under those conditions, the solution to Eq. Before we examine the properties and implications of Eq. Analysis of these solutions shows 3 that the Ei-function solution is an accurate approximation to the more exact solution for time 3. In practice, we find that most wells have reduced permeability damage near the wellbore resulting 0. Many other wells are stimulated by acidization or hydraulic fracturing.

Chapter 2 : Well Testing (SPE textbook series): John Lee: www.nxgvision.com: Books

Well Testing John Lee Professor of Petroleum Engineering Texas A&M University First Printing Society of Petroleum Engineers of AIME New York Dalias.

Printed in the United States of America. This book, or parts thereof, cannot be reproduced in any form without written con- sent of the publisher. Afier receiv- ing a PhD degree from Georgia Inst. He was associate profcsso r of pelroleurn engineering at Mississippi Slalc U. He has beco faeu lly adviser 10 the SPE student chapter during several school years. Acknowledgments Many individuals ha ve contributed to the completion of this textbook. The contributions of the following in- dividuals have been particularly helpful: Smith , who provided thorough and helpful reviews of early drafts; Georgeann Bilich, who effectively dealt with manuscript problems no author has any right to intlict on a technical editor, and who did so in her characteristic gracious way; and Erin Stewart, SPE Associate Editor, who successfully put it all together despite at times an almost total lack of cooperation from anyone. To all of you and the many others who helped-thank you! The Series is intended to ensure availability of high-quality textbooks for use in undergraduate courses in areas clearly identified as being within the petroleum engineering field. The Textbook Coordinator and the Textbook Com- mittee provide technical evaluation of the book. Below is a listing of those who have been most closely in- volved in the final preparation of this book. Many others contributed as Textbook Committee members or others involved with the book. Fluid Flow in Porous Media 1. Pressure Buildup Tests 2. Type Curves for Fractured Wells 5. Gas Well Testing 6. Answers to Selected Exercises Nomenclature Bibliography Author Index Subject Index Introduction This textbook explains how to use well pressures and flow rates to evaluate the formation surrounding a tested well. Basic to this discussion is an un- derstanding of the theory of fluid flow in porous media and of pressure-volume-temperature PVT relations for fluid systems of practical interest. 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If a well is damaged ks k , s will be negative, and the deeper the stimulation, the greater the numerical value of s. Rarely does a stimulated well have a skin factor less than -7 or - 8, and such skin factors arise only for wells with deeply penetrating, highly conductive hydraulic fractures. We caution the reader that Eq. Before leaving the discussion of skin factor, we should point out that an altered zone near a par- ticular well affects only the pressure near that well - i. Said another way, we use Eq. We have presented no simple equations that can be used to calculate pressures for radius, " such that, w 6 the reservoir is still infinite acting at this time. Thus, for times less than , hours, we can use Eq. Note, as indicated in the table, that it is a negative quantity. Here we note that for an argument of We now discuss the next solution to the radial diffusivity equation that we will use extensively in this introduction to well test analysis. Actually, this solution the pseudosteady- state solution is not new. This result leads to a form of well testing sometimes called reservoir limits testing, which seeks to determine reservoir size from the rate of pressure decline in a wellbore with time. Another form of Eq. The volumetric average pressure within the drainage volume of the well can be found from material balance. For example, in Eq. Note that for a damaged well, the average permeability k j is lower than the true, bulk for- mation permeability k; in fact, these quantities are equal only when the skin factor s is zero. Thus, there is a need for a more complete means of characterizing a producing well than exclusive use of PI information. A recent pressure survey showed that average reservoir pressure is 2, psi. Logs indicate a net sand thickness of 10 ft. Fluid samples indicate that, at current reservoir pressure, oil viscosity is 0. Estimate formation permeability from these data. Core data from the well indicate an effective permeability to oil of 50 md. Does this imply that the well is either damaged or stimulated? What is the apparent skin factor? To estimate productivity index, we use Eq. We do not have sufficient information to estimate formation permeability; we can calculate average permeability, k j , only, which is not necessarily a good approximation of formation permeability, k. Core data frequently provide a better estimate of formation permeability than do permeabilities derived from the productivity index, particularly for a well that is badly damaged. Since cores indicate a permeability of 50 md, we conclude that this well is damaged. A similar equation 5 models pseudo- steady-state flow in more general reservoir shapes: Values of CA are given in Table 1. Productivity index, J, can be expressed for general drainage-area geometry as q 0. In the transient region, the reservoir is infinite acting, and is modeled by Eq. At times between the end of the transient region and the beginning of the pseudosteady-state region, this is a transition region, sometimes called the late-transient region, as in Figs. No simple equation is available to predict the relationship between BHP and time in this region. This region is small or, for practical purposes nonexistent for a well centered in a circular, square, or hexagonal drainage area, as Table 1. However, for a well off-center in its drainage area, the late-transient region can span a significant time region, as Table 1. Note that the determination of when the transient region ends or when the pseudosteady-state region begins is somewhat subjective. For example, the limits on applicability of Eqs. Other authors 1 consider the deviation from Eq. These apparently contradictory opinions are nothing more than different judgments about when the slightly approximate solutions, Eqs. These concepts are illustrated in Example 1. For the well centered in one of the quadrants of a square, write equations relating constant flow rate and wellbore pressure drops at elapsed times of 30, , and hours. We then prepare the following table values from Table 1. Substituting, dp w dt. As a second example, consider a wellbore Fig. Note, however, that we are forced to make a significant simplifying assumption:

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Air formasi adalah air yang ikut terproduksi bersama-sama dengan minyak dan gas. Air ini biasanya mengandung bermacam-macam garam dan asam.

Chapter 6 : CASA PETROLERA: Well Testing (en espaÃ±ol)

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Chapter 7 : Well Testing by John Lee

Well test interpretation, which is the process of obtaining information about a reservoir by analyzing the pressure transient response caused by a change in production rate, plays a very important part in making overall reservoir-management decisions.

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