

# Decline Analysis

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Many software packages exist in the petroleum industry that extrapolate trends in the production rate data from oil and gas wells to forecast future production and ultimate cumulative reserve recovery - a process known as decline analysis. The software often makes an attempt to fit a production decline trend through historical data using a best fit approach through all of the data, but the result is erroneous in the majority of cases. A human operator with an understanding of the factors that affect the behavior of oil and gas wells can do a much better job of forecasting appropriately; however, it is a time consuming process. Essentially the software can perform decline analysis rapidly on a large number of wells incorrectly, while a human can do proper decline analysis slowly.

The problem posed, and the objective of its solution, is to develop an algorithm that will allow software to approach the decline analysis the way a human operator would, and raise the success rate for automated decline analysis from an estimated 5 to a more acceptable 80 based on a set of rules which could improve on the current situation. However, alternative methods to solving the problem are certainly possible, as is the optimization and development of the ideas already conceived.

Attached are three examples of decline forecasts for natural gas wells generated by the common best fit approach, and the corresponding results generated by human analysis. Within the industry the former would be considered meaningless while the latter would be considered to be the reasonable product of professional judgement. The task often arises to analyze hundreds of wells in a short period, which can involve many man-hours of work that can become very tedious - an ideal situation for a software algorithm that would generate results that could be quickly checked for validity.

A successful solution to this problem would have widespread practical uses. These would occur not only in the petroleum industry where the decline trends of tens of thousands of wells are of almost daily concern, but in other areas where forecasting future trends is done based on historical data such as economic forecasting of sales trends. Thus the problem is of both academic and practical interest.

In the attached pictures the red lines are raw data and the blue lines are the decline curves.

















