

MinInversion

Manual

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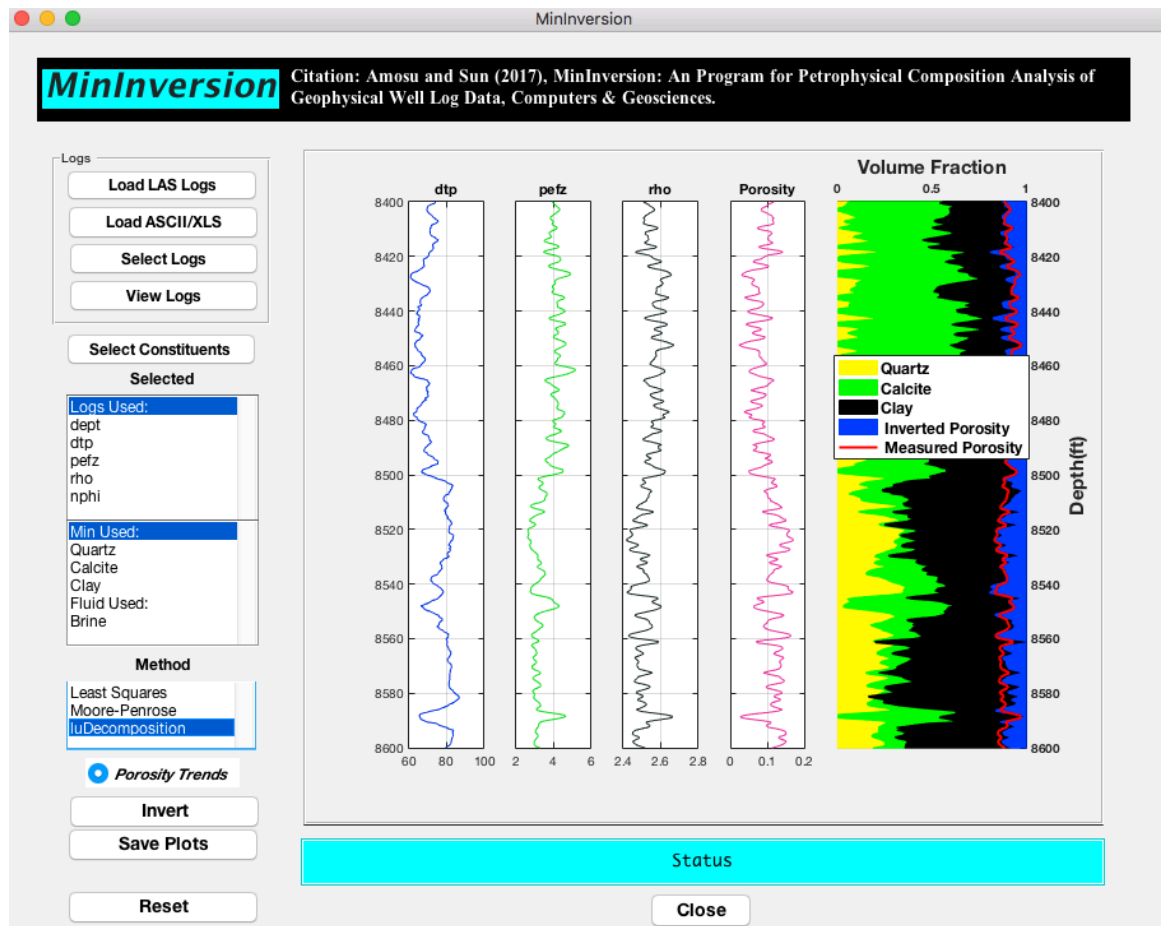
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MinInversion Usage

MinInversion is a program for petrophysical mineral composition analysis of geophysical well logs. It is written in Matlab 2017a. Before reading this manual, watch the video demonstrating the usage of the program. The video “MinInversion_DEMO.avi” can be found in the supplementary folder in this package. The program can be launched by “double-clicking” the “MinInversion.m” file. Make sure the “.m” and “.fig” files are in the same location.



The program can be run using the following simple steps:

1. **Input:** The “Load LAS Logs” program allows the user to interactively select geophysical logs in the standard LAS (Log ASCII Standard) file format. The LAS format is a standard file format common in the oil and gas and water well industries for storing well logging data. The “Load ASCII/XLS” button lets the user input geophysical well log data in tabular ascii format, Microsoft Excel or comma-separated-value formats.
2. **Choosing Logs:** After loading the input data, the “Select Logs” button let’s the user choose the logs to be used in the inversion and match the selected logs with mnemonics recognized by the program. The selected logs appear in the first panel on the left in the GUI.
3. **Viewing Logs:** The “View Logs” button allows the user to display the selected logs in the program’s main display axes. **Selecting Rock Constituents:** The “Select Constituents” button is used to select the mineral and fluid components with make up the rock. The program suggests the number of components to select based on the number logs available from the previous selection. The constituents are selected from the library of petrophysical properties (which can be easily expanded by the user). The selected constituents appear in the second panel on the left in the GUI. Table (1) shows a section of the library of petrophysical properties. The default table can be modified in the program or a new table can be input as an excel file during the program execution. An example of the format of the new table “Example_DefaultMin.xls” can be found in the “dependencies” folder.

4. Inversion Method: The program currently permits inversion using three methods: least squares, Moore-Penrose generalized inversion and LU- decomposition methods. The “Invert” button calculates a solution to the linear system of equations constructed from the selected logs and constituents using the method selected in the “Method” panel. The results composition volume is then displayed alongside the logs in the main display axes. If the “Porosity Trends” button is toggled on and the porosity logs have been loaded, the program generates plots of joint probability distribution of measured porosity with constituent proportions.
5. Other features: The status bar displays the current status of the program during any of the above processes. The “Save plots” generates high-resolution images of the logs, the composition volume, a combination plot of logs and composition, and the joint probability distribution plots in a folder labeled “MinInversion_Output” located in the current Matlab folder. The “Reset” button is used to clear the memory and reset the program.

Table 1: Table showing a section of the library of Petrophysical properties. The value “-999.25” is used to represent values that are not available.

Mineral	DENS(g/cc)	DT(μ sec/ft)	DTS(μ sec/ft)	VP(m/s)	VS(m/s)	PE
Quartz	2.65	43.9	88.8	6037.618	4120.817	1.82
Shale	2.6	62.5	150	2559.92	1129.865	3.42
Calcite	2.71	47.2	89.9	2559.92	3436.294	5.09
Clay	2.65	64.3	98.9	5966.288	3079.512	3.03
Dolomite	2.87	43.9	74.8	7346.572	3959.728	3.13
Anhydrite	2.95	50	85	6105.553	3366.502	5.08
Gypsum	2.35	52.4	85.4	6513.389	3603.75	4.04
Muscovite	2.83	47.2	91.1	5773.503	3342.187	2.4
Biotite	3.2	55.5	100.6	5374.838	3027.65	8.59
Kaolinite	2.64	64.3	101.7	5637.622	2995.899	1.47
Glauconite	2.83	55.5	157.4	3257.566	1935.282	4.77
Illite	2.77	64.3	98.9	5966.288	3079.512	3.03
Chlorite	2.87	55.5	61.3	9268.864	4969.107	4.77
Orthoclase	2.54	68.9	84.9	4926.98	3586.239	2.87
Siderite	3.91	43.9	84.9	6957.664	3588.703	14.3
Pyrite	5	39.6	55.9	8429.065	5448.052	16.4
Halite	2.03	6.7	114.5	4594.683	2661.453	4
FreshWater	1	205	-999.25	1482	-999.25	0.36
Brine	1.1	188	-999.25	1522	-999.25	0.81
Oil	0.85	238	-999.25	1280	-999.25	0.12