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Esmail Ansari, Richard Hughes, Christopher White



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1 Statistical Modeling of Geopressured Geothermal Reservoirs

2 Esmail Ansari^{a,*}, Richard Hughes^a, Christopher White^b3 ^aLouisiana State University, Baton Rouge, LA, 708034 ^bTulane University, New Orleans, LA, 701185 **Abstract**

6 Identifying attractive candidate reservoirs for producing geothermal energy requires predictive models. In
7 this work, inspectional analysis and statistical modeling are used to create simple predictive models for
8 a line drive design. Inspectional analysis on the partial differential equations governing this design yields
9 a minimum number of fifteen dimensionless groups required to describe the physics of the system. These
10 dimensionless groups are explained and confirmed using models with similar dimensionless groups but differ-
11 ent dimensional parameters. This study models dimensionless production temperature and thermal recovery
12 factor as the responses of a numerical model. These responses are obtained by a Box-Behnken experimental
13 design. An uncertainty plot is used to segment the dimensionless time and develop a model for each seg-
14 ment. The important dimensionless numbers for each segment of the dimensionless time are identified using
15 the Boosting method. These selected numbers are used in the regression models. The developed models
16 are reduced to have a minimum number of predictors and interactions. The reduced final models are then
17 presented and assessed using testing runs. Finally, applications of these models are offered. The presented
18 workflow is generic and can be used to translate the output of a numerical simulator into simple predictive
19 models in other research areas involving numerical simulation.

20 *Keywords:* Predictive model, Statistical model, Experimental design, Geothermal reservoir, Inspectional
21 analysis, Dimensional analysis

22 **1. Introduction**

23 Developing geopressured-geothermal reservoirs reduces global warming and secures energy needs. Iden-
24 tifying attractive candidate reservoirs for producing geothermal energy requires quick and simple models
25 because simulating each case individually is expensive. One approach to translate the output of a simulator
26 into quick models with general applicability at all scales is to combine inspectional analysis with statistical
27 modeling.

*Corresponding author

Email addresses: eansar2@lsu.edu (Esmail Ansari), rg Hughes@lsu.edu (Richard Hughes), cwhite18@tulane.edu (Christopher White)

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