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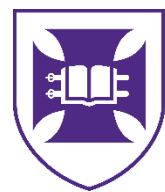Brisbane Convention & Exhibition Centre, Brisbane, Australia

Paper No: SPE-198251-MS
Impacting Factors on Horizontal Coal Seam Gas Well Production and Proxy Model Comparison

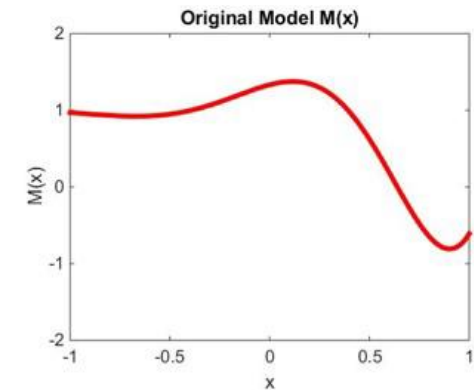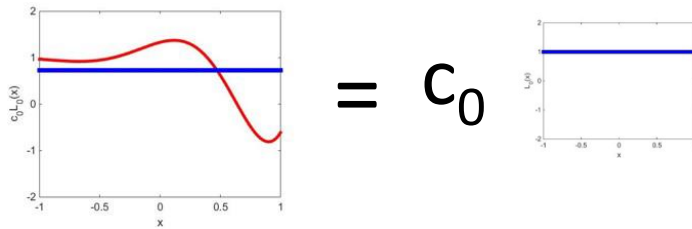Qian Wang, Diane Donovan, Thomas Reay, Iain Rodger, Bevan Thompson, Fengde Zhou, Xianbo Su, Emine Sule Yazici,

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Centre for Natural Gas

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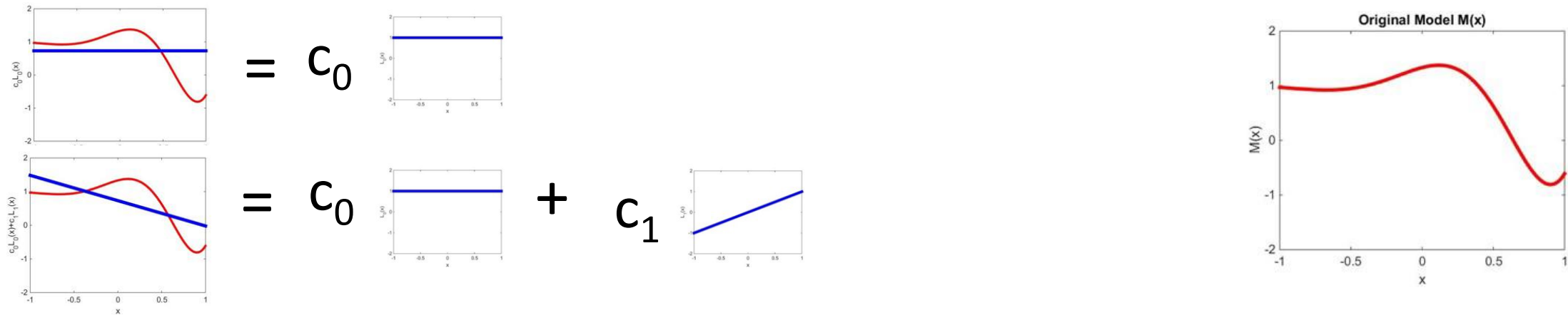Brisbane Convention & Exhibition Centre, Brisbane, Australia

What is the basic idea of a proxy model?

- PCE proxy models deliver an accurate approximation by summing carefully chosen individually **weighted** functions over multiple input parameter space.

$$= c_0$$

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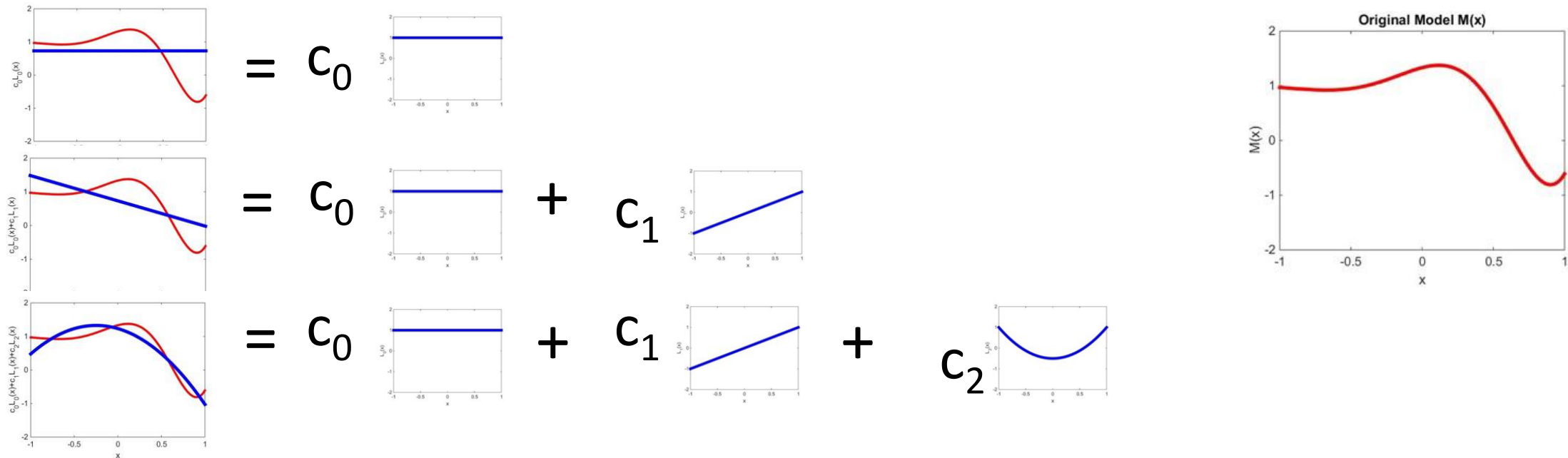
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$$= c_0$$

$$= c_0 \quad + \quad c_1$$

Original Model M(x)

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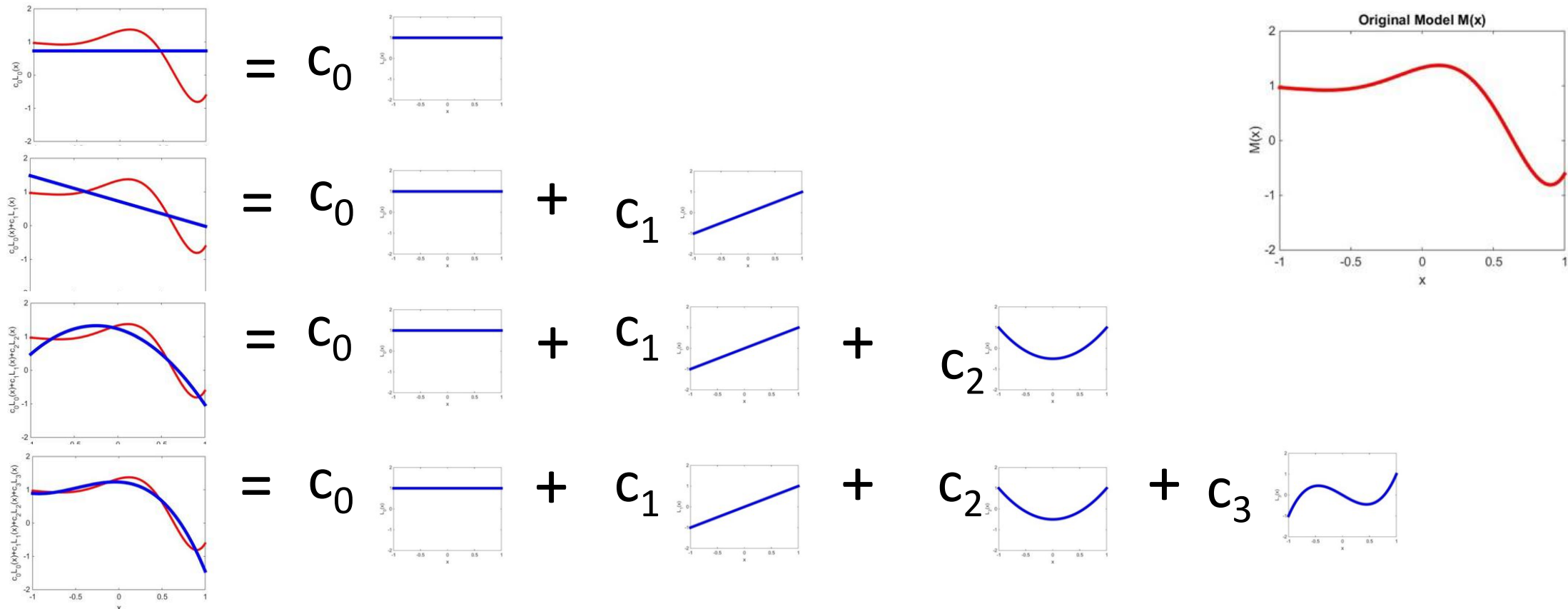
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What are the advantages of proxy modelling?

- PCE proxy models deliver accurate approximation by strategically summing weighted functions over multiple input parameter space.
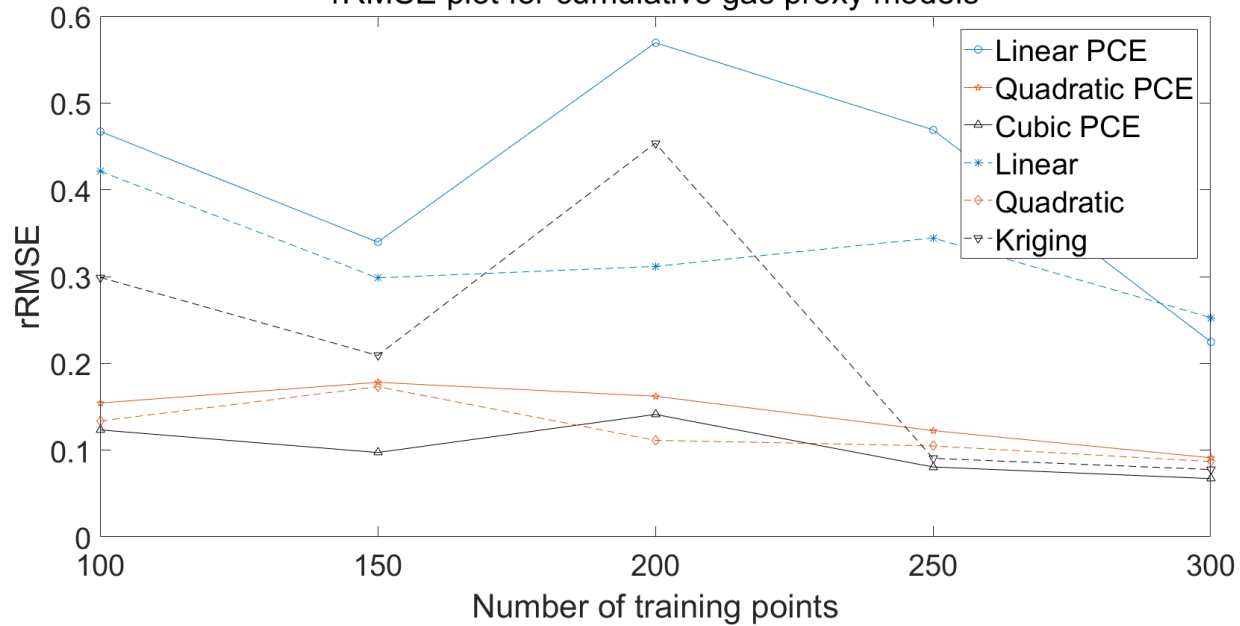

$$\mathcal{M}(x) = c_0 \underline{\quad} + c_1 \diagup + c_2 \smile + c_3 \sim + \cdots$$

The mean | Capturing how the model varies
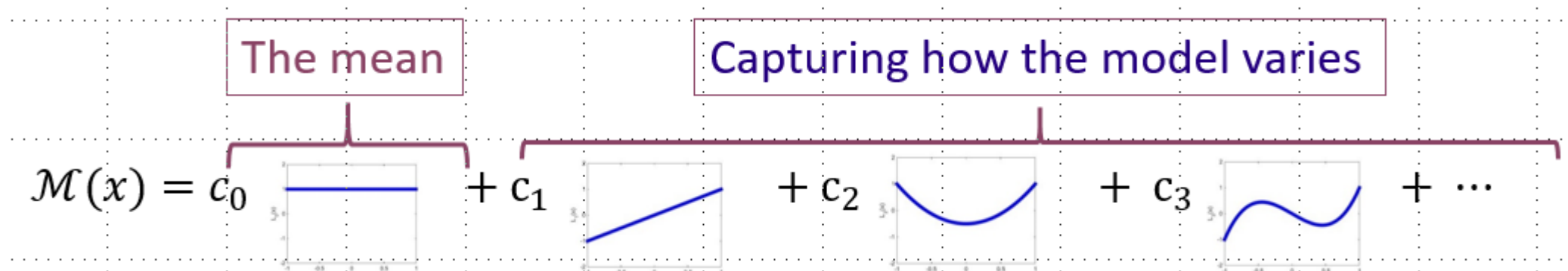
- Polynomials are orthogonal with respect to statistical distribution input parameters:
    - reducing complexity;
    - capturing uncertainty in the input parameters;
    - identifying sensitivity of the model to key input parameters.

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Horizontal wells: modelling of cumulative gas production & peak gas rate
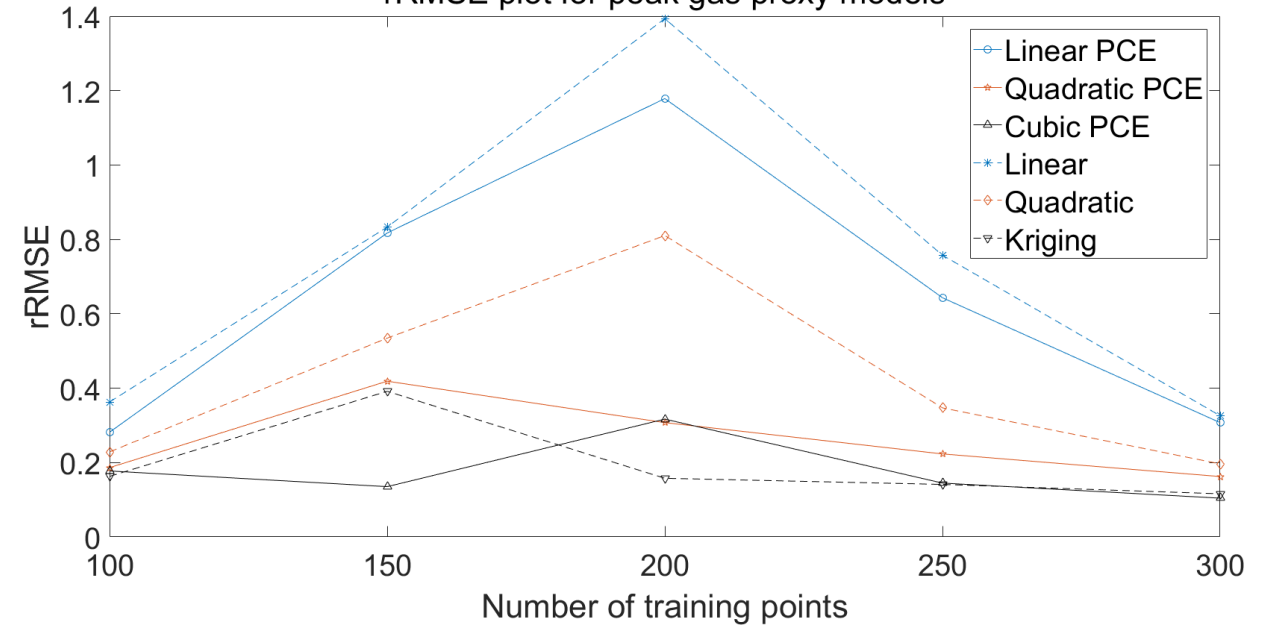
- For 10 years, with uncertainty in 6 inputs: reservoir permeability, porosity, gas content, gas saturation, horizontal well angle wrt principal permeability.

- Training data: use simulator to evaluate cum. gas production, $(x, C(x))$ & peak gas rate $(x, P(x))$.

- Validation data: use simulator to evaluate cum. gas production $(v, C(v))$ & peak gas rate $(v, P(v))$.

- On training data construct linear, quadratic and cubic PCE proxy models & linear, quadratic and UK proxy models from a commercial software package.

- On validation data calculate error between simulator and proxy model estimates.

- For best performing proxy model conduct sensitivity analysis & check confidence intervals.

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How do the various proxy modelling techniques perform?

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How the variables impact on the gas production?

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• Diane Donovan
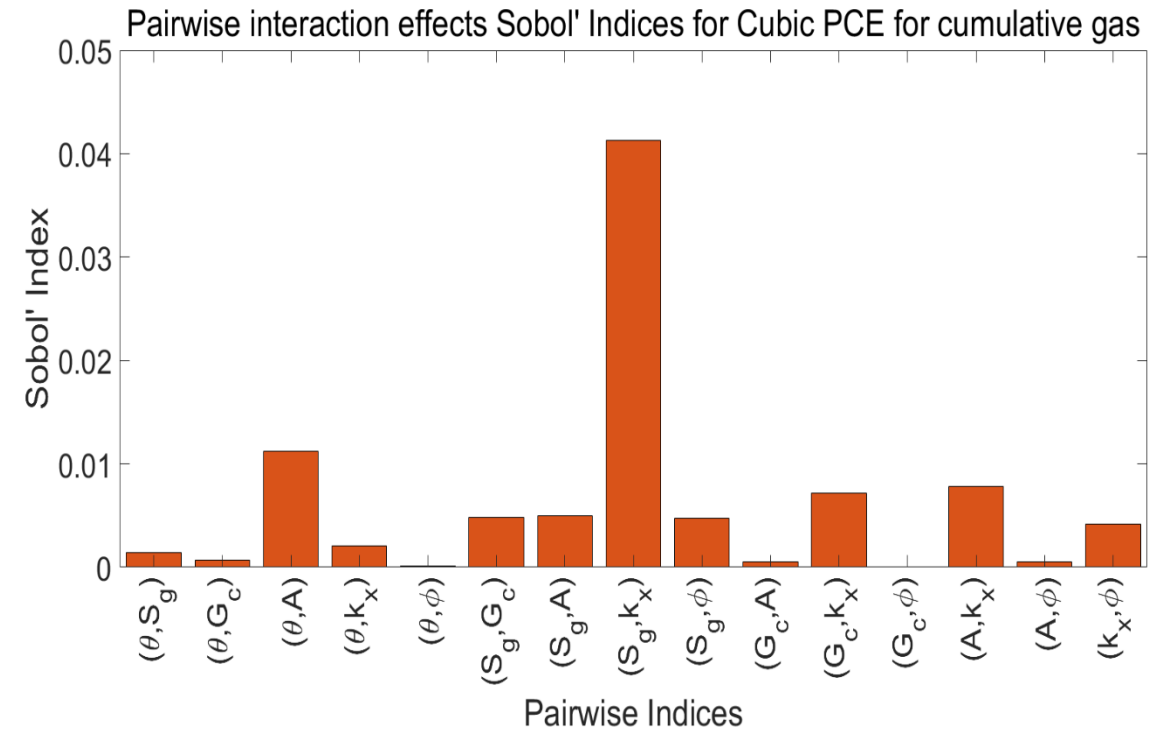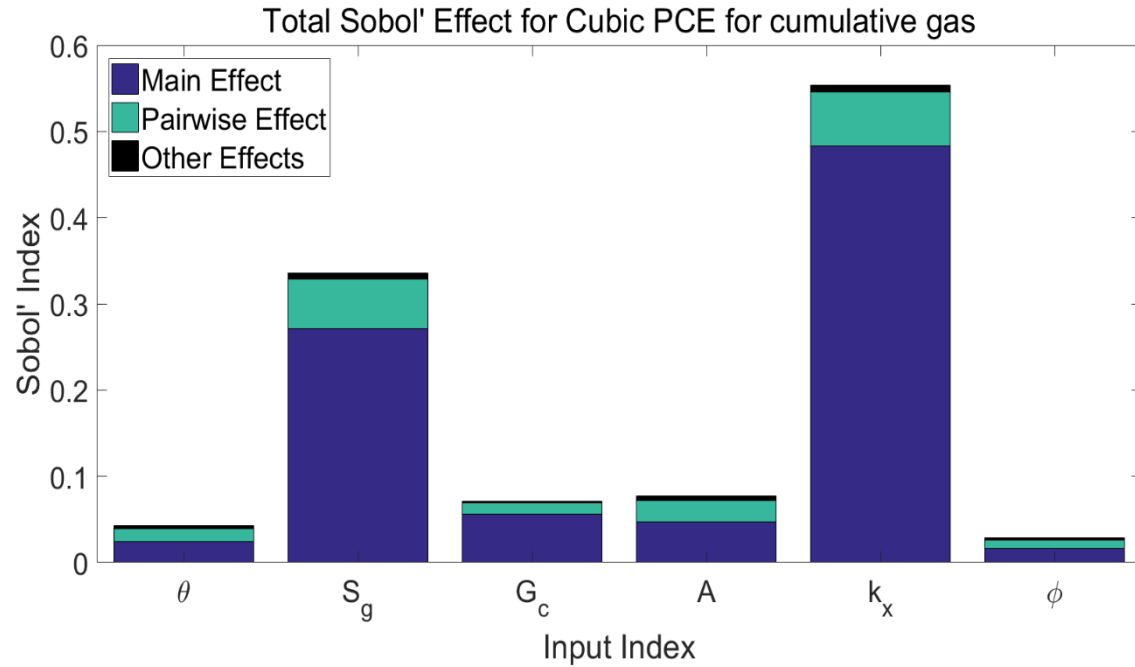
Cumulative distributions of the gas production
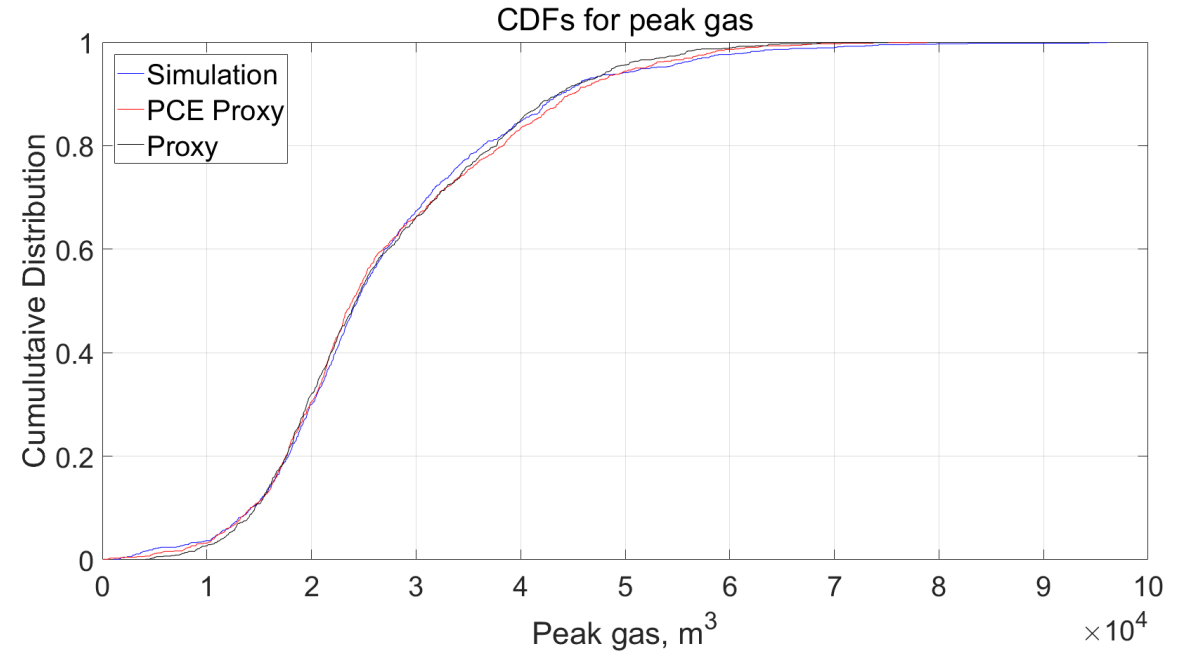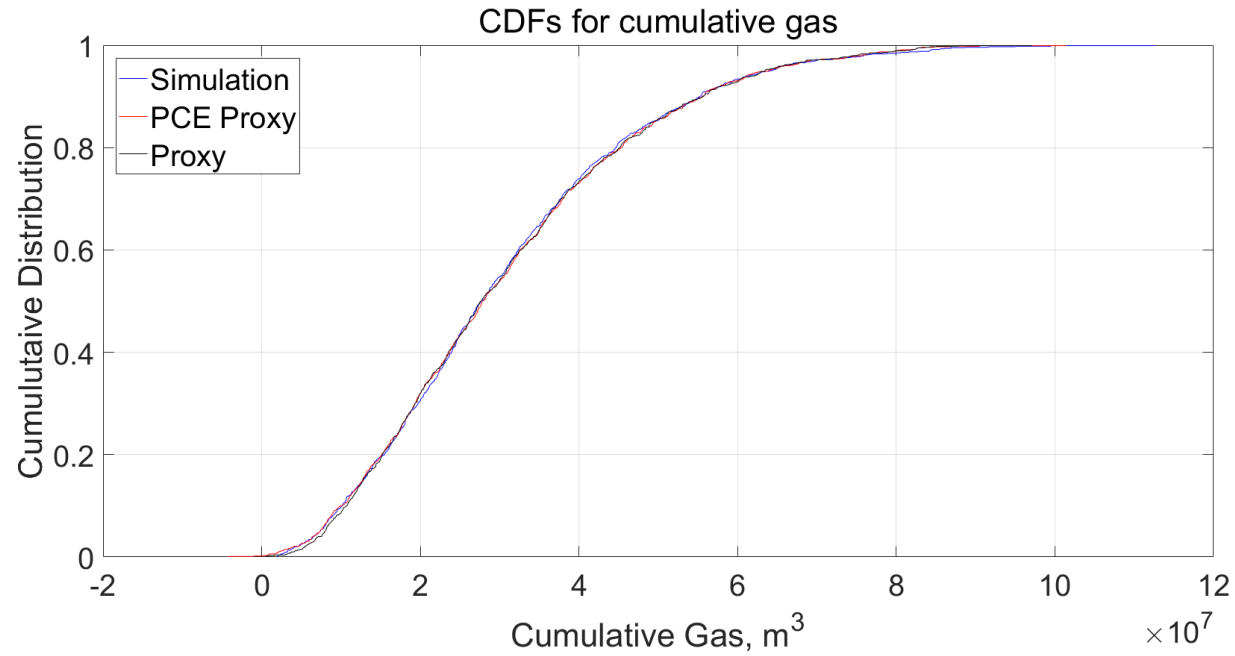
In Summary

- Proxy modelling tools provide fast, first pass simulations for the production of valuable forecasting information.

- Proxy models based on PCE techniques compare well with proxy modelling tools available through some commercial packages.

- PCE provides additional benefits including direct access to sensitivity analysis.

Thank You For Listening / Questions