Block-Partitioning For Multi-Wavelet Polynomial Chaos Expansions

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Polynomial Chaos Expansions

- **What is a polynomial chaos expansion?**

Suppose we have the problem $u = f(t, \lambda, u)$,

where λ *is an uncertain parameter ,* $\lambda \sim N(\mu, \sigma^2)$.

We can write the polynomial chaos expansion as

$\lambda = \sum_{k=1}^{\infty} u_k \Psi_k(\xi)$, Ψ_k *are Hermite polynomials*

so here $\lambda = \mu + \sigma\xi$, *where* $\xi \sim N(0,1)$.

Multi-Wavelets & Partitioning

- **Problems with Gaussians**
  - **Infinite support**
- **Multi-Wavelets**
  - **Compact support**
- **Domain Space Partitioning**
  - **Refined compact support**

Where do I come in?

- **Block-Partitioning Methods Exist**
  - **Used for specific problems**
- **General Software Implementation**
  - **Generic functionality**
  - **Add to existing uncertainty quantification library**

Getting A Handle On Things

- Learn about polynomial chaos expansions
  - Reading lots of technical papers
- Learn how the method will be used
  - Analyze examples of block-partitioning
  - Compare with algorithm in technical papers

Writing The Code

- **Sample Problem**
- **General Function**
  - **Expand the sample case**

Testing, Testing, Testing,...

- **Compare mean and standard deviation.**
- **Compare probability density functions.**

Benefits To Sandians

- **Powerful software tool**
  - **Black-box function**
- **Speed up model generation**

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