Anisotropic Sparse Grids

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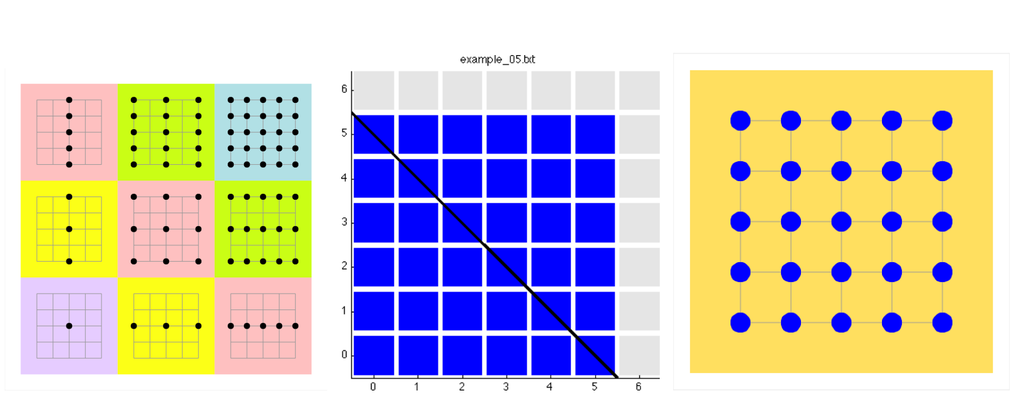
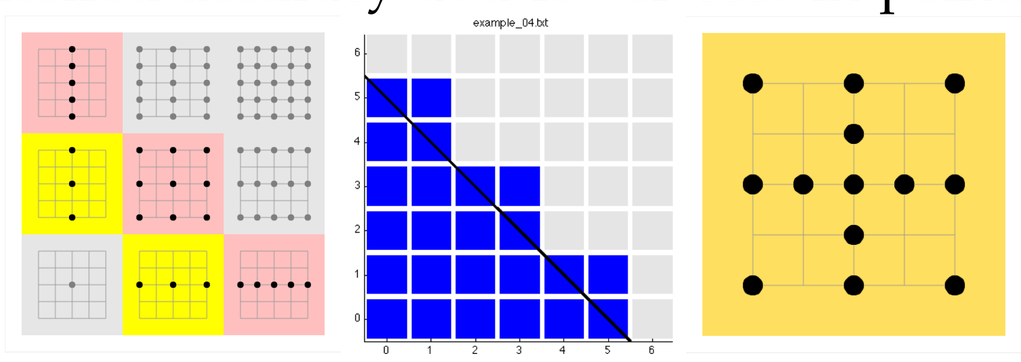
Sparse Grids



The desired accuracy is the diagonal line. A single product grid can only cover this line by covering the entire square. The excess accuracy is reflected in the high number of points. By combining lower order product rules, a sparse grid reaches the same desired accuracy at a lower cost in points.

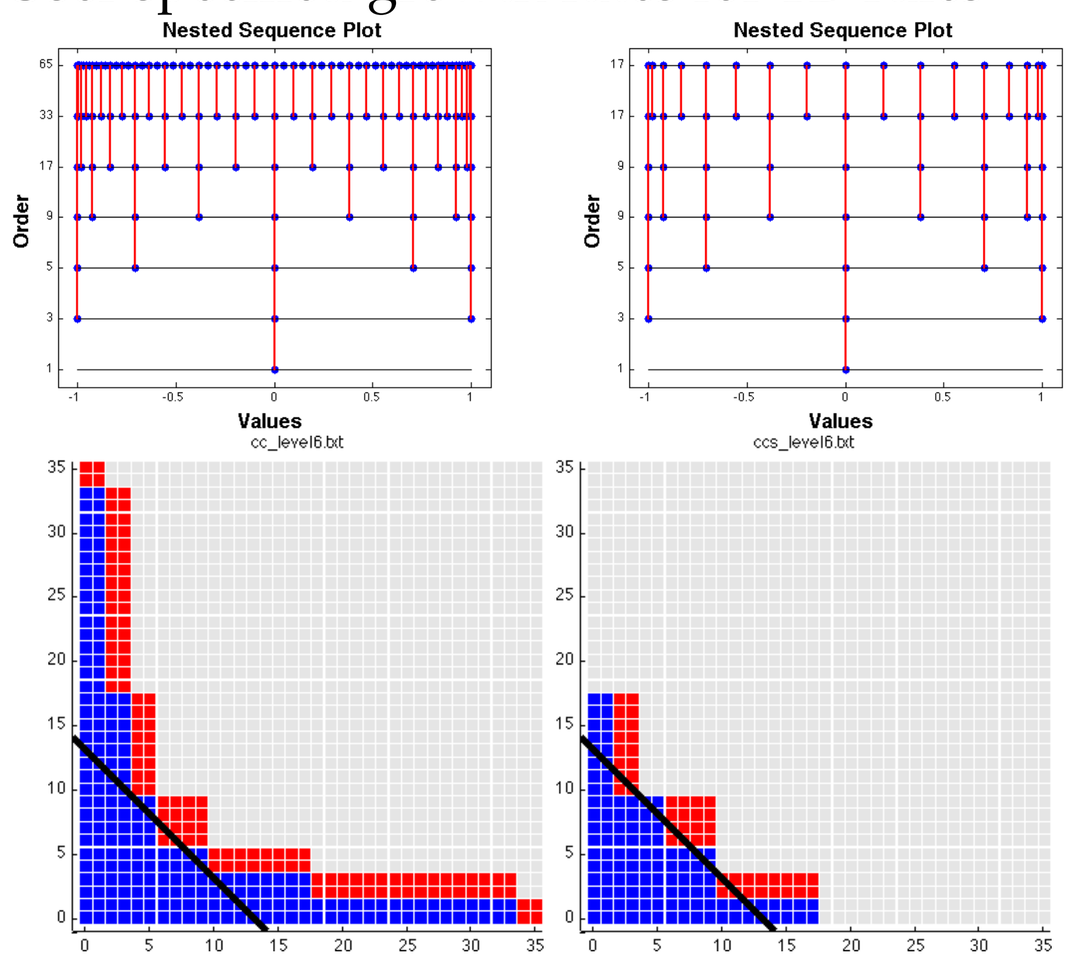


M	P(Product Rule)	P(Sparse Grid)
10	4.0	15
20	2.0	9 or 11
30	1.6	9 or 11
50	1.3	7 or 9
100	1.1	7

Table 1: Achievable Precision with 10^6 points.

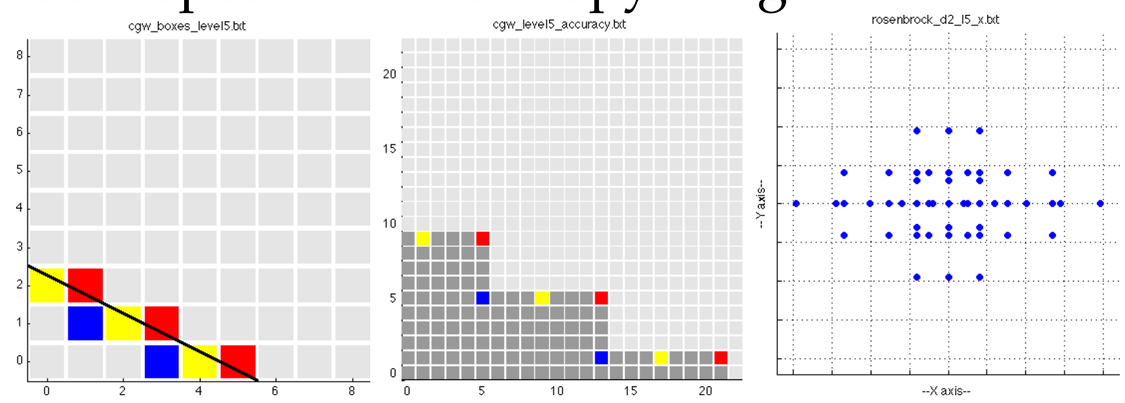
Growth Rules

User specified growth rates for 1D rules



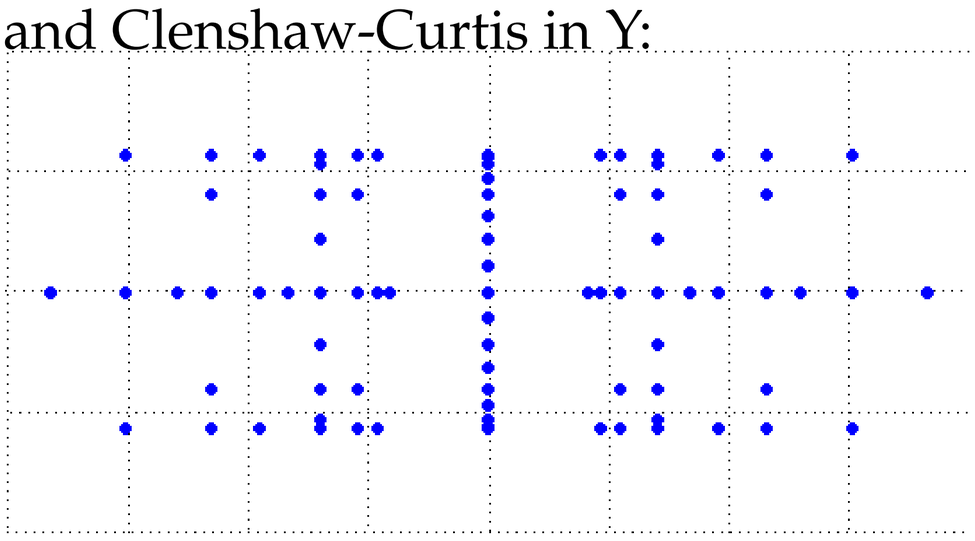
Anisotropy

User-specified anisotropy weights:



Mixed Families

Each spatial dimension of a sparse grid can use a separate indexed family of 1D quadrature rules. Here, we use Gauss-Hermite in X and Clenshaw-Curtis in Y:



Reference

Nobile, Tempone, Webster,
An Anisotropic Sparse Grid Stochastic Collocation Method for Partial Differential Equations with Random Input Data,
SINUM, 46(5), 2008, p2411-2442.

Acknowledgement

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