A Universal Lattice-based Algorithm for Multivariate Function Approximation in Uncertainty Quantification

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We present an algorithm, using rank-1 lattice points, to approximate multivariate periodic functions that does not require the smoothness. Rank-1 lattice points are characterised by a generating vector which in turn determines the quality of the approximation. We propose a component-by-component (CBC) construction to construct a generating vector for function approximation without prior information on smoothness parameters. This means the resulting generating vector can be used for any smoothness. The lattice-based algorithm independent of smoothness leads to almost the same convergence rate as previous lattice algorithms in papers *Cools, Kuo, Nuyens & Sloan* (*2020*) and *Kuo, Mo & Nuyens* (*2024+*), except for some logarithmic factor. The error bound is independent of dimension for appropriately chosen weight parameters.

[1] Cools, R., Kuo, F.Y., Nuyens, D., Sloan, I.H.: *Lattice algorithms for multivariate approximation in periodic spaces with general weights.* Contemp. Math. **754**, 93–113 (2020).

[2] Kuo, F.Y., Mo, W., Nuyens, D.: *Constructing embedded lattice-based algorithms for multivariate function approximation with a composite number of points.* doi:10.48550/arXiv.2209.01002.