

Multiscale Approximation by Radial Basis Functions

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Radial basis functions (RBFs) are a popular meshfree discretisation method. They are used in various areas comprising, for example, scattered data approximation, computer graphics, machine learning, aeroelasticity and the geosciences.

The approximation space is usually formed using the shifts of a fixed basis function. This simple approach makes it easy to construct approximation spaces of arbitrary smoothness and in arbitrary dimensions.

Multiscale RBFs employ radial basis functions with compact support. In contrast to classical RBFs they do not only use the shifts of a fixed basis function but also vary the support radius in an orderly fashion. If done correctly, this leads to an extremely versatile and efficient approximation method.

In this talk, I will discuss the basic ideas of multiscale RBFs, I will give and analyse an explicit algorithm for the reconstruction of multivariate functions from scattered data. After that, I will discuss how multiscale RBFs can be used for data compression, for the resolution of different scales in the target function and how they can be used to solve partial differential equations numerically.