A shape preserving quasi-interpolation operator based on a new transcendental RBF

Maryam Mohammadi
Kharazmi University (Iran)

Abstract

In recent decades, the radial basis function (RBF) interpolation has provided an outstanding tool for scattered data approximation on multidimensional cases. The Multiquadric (MQ) RBF proposed by Hardy, is undoubtedly the most popular RBF that is used in many applications and is representative of the class of global infinitely differentiable RBFs. Although the MQ interpolation is always solvable, the resulting matrix quickly becomes ill-conditioned as the number of points increases. Researchers concentrated on a weaker form of interpolation, known as quasi-interpolation, that holds only for polynomials of some low degree. It is well-known that the univariate Multiquadric quasi-interpolation operator is constructed based on the piecewise linear interpolation by $|x|$. In this talk, we first introduce a new transcendental RBF based on the hyperbolic tangent function as an smooth approximant to $\phi(r) = r$ with higher accuracy and better convergence properties than the MQ RBF $\sqrt{r^2 + c^2}$. Then the Wu-Schaback's quasi-interpolation formula is rewritten using the proposed RBF. It preserves convexity and monotonicity. We prove that the proposed scheme converges with a rate of $O(h^2)$. So it has a higher degree of smoothness. Some numerical experiments are given in order to demonstrate the efficiency and accuracy of the method.

This is a joint work with Mohammad Heidari and Stefano De Marchi.