Interpolation Techniques Based on Local Radial Basis Function Differential Quadrature Method

Yi-Ling Chan, Chien-Ting Wu, Li-Hsuan Shen, Der-Liang Young

Department of Civil Engineering, National Taiwan University
1, Sec. 4, Roosevelt Rd., Taipei Taiwan
dlyoung@ntu.edu.tw
r98521301@ntu.edu.tw

An interpolation technique based on the local differential quadrature (LDQ) method is proposed to interpolate the unknown data value with arbitrarily scattered given data. By employing the multiquadric radial basis functions (MQ) as test functions, the LDQ method is a mesh-free numerical scheme with high accuracy. In this study, the unknown data are interpolated with the help of the field gradients, which take care of the geometric properties, and the governing equations, which forces the interpolated data to satisfy the physical principles. Further, an optimum scheme that combines the merits of both is also present. Three-dimensional numerical examples governed respectively by the Poisson and the advection-diffusion equations are performed to validate the accuracy and the stability of the interpolation technique. The present results, comparing with the results by the linear polynomial fitting (LPF) method and the quadratic polynomial fitting (QPF) method, shows that the present interpolation technique is more accurate and robust than conventional ones.

Keywords: Interpolation, Meshless numerical method, Local differential quadrature, Radial basis functions (RBFs), Advection-diffusion equations.