Title :

Scattered Data Interpolation Using Rational Triangular Spline for Energy Computing

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Background :

In the era IR4.0 and IR5.0, the need of efficient method to produce faster simulations are necessary. For instance, the graphical visualization for large data sets or to process and display 3D images of various objects. All required efficient and faster algorithm without any lagging.

Targets:

Various government agencies including Meteorological department, environmental department, universities and all ESG companies.

Proposed Method

The proposed method is explained in the following paragraph:

Algorithm 1 (Scattered Data Interpolation)

Step 1: Input Scattered Data points: (x,y,z)

Step 2: Estimate the partial derivative at each data points.

Step 3: Triangulate the domain of data points by using Delaunay triangulation for 2D data sets i.e., (x,y) only.

Step 4: Calculate boundary control points.

Step 5: Calculate inner control points for local scheme, b_{111}^{i} , $i = 1,2,3$ by using cubic precision method that will guarantee the proposed method has cubic precision.

Step 6: Construct the interpolating surface using convex combination method of three local schemes.

Step 7: Calculate CPU time, R^2 and maximum error. Repeat steps 1 until 6, for the other data sets.

Impact

Impact of the proposed method:

1. Scientific and technological:

Comparison against some established schemes indicate that, the proposed scheme is better since its achieved CPU times just about 12.5% from CPU time by using another scheme. This is very significant in visualizing big scattered data sets which have variety of applications in ICT and Big Data Analytics.

2. Societal: The proposed method is suitable for real-life application.

3. Collaborative: The proposed method can be further improved by collaborate with various experts in scattered data interpolation and approximation.

Output/Outcome:

Output or outcome of your proposed method :

1. Scientifically, **the proposed method is new and its faster than all existing methods with factor 1/8 i.e., eight times faster than existing scattered data interpolation method.**

2. Societal, the data sets are provided for public use. They can compare the performance with their own method

3. Collaborative, **throughout this study, we are able to secure the Fundamental Research Grant Scheme (FRGS) by the Ministry of Higher Education, Malaysia recently.**

[FRGS/1/2023/ICT06/ UMS/02/1] (New Scattered Data Interpolation Scheme Using Quasi Cubic Triangular Patches for RGB Image Interpolation)

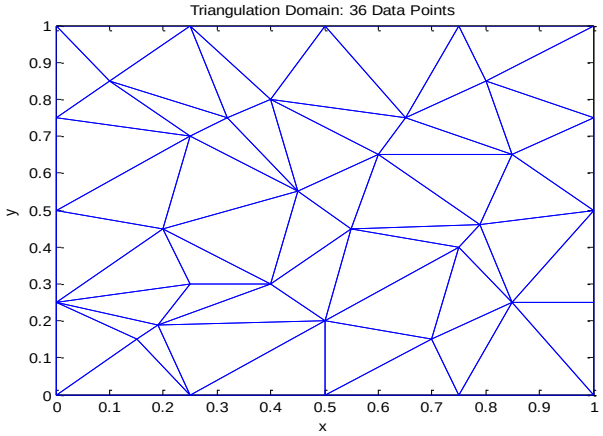
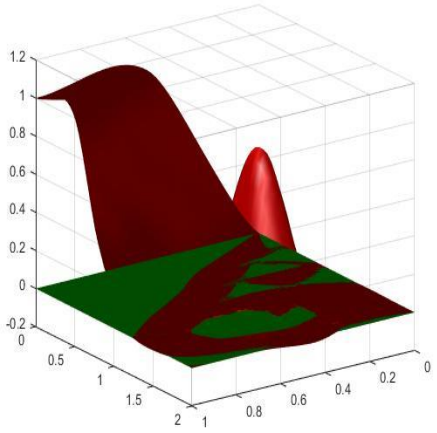
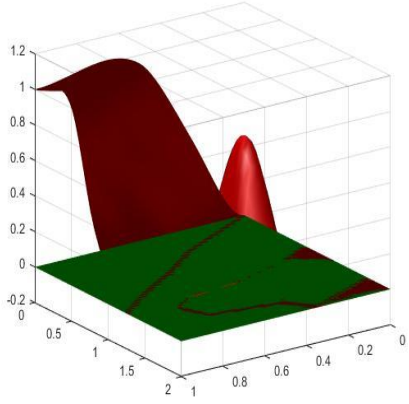


Figure 1: Delaunay triangulation



(a) Non-positivity surface



(b) positivity preserving surface

Figure 2: Scattered data interpolation

Table 1: CPU time (in seconds)

Size Data	Interpolation points	Function	CPU time (in seconds)	
			The proposed scheme	Quartic Bézier
36	1296	F1	0.6587	1.5653
33	1296	F2	1.0159	2.6322
25	377	F3	0.0935	1.1535
100	1697	F4	0.5168	18.5996

Conclusion

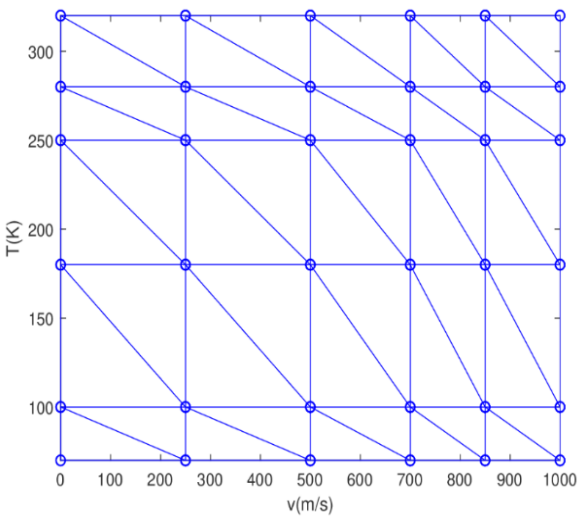
Presentation summarize:

1. Targets: To produce an efficient and faster scattered data interpolation method for large data sets.

2. Method: Constructing new scheme for scattered data interpolation with free parameters.

3. Scientific and societal impact: The method is new, and it is 8 times faster than existing scattered data interpolation scheme.

Visualizing Kinetic Energy



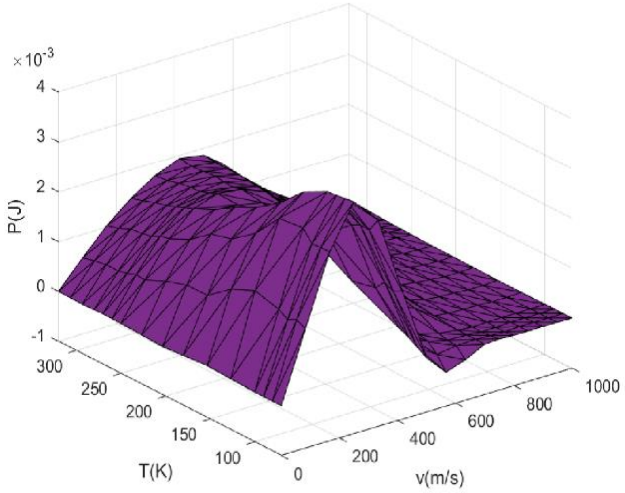
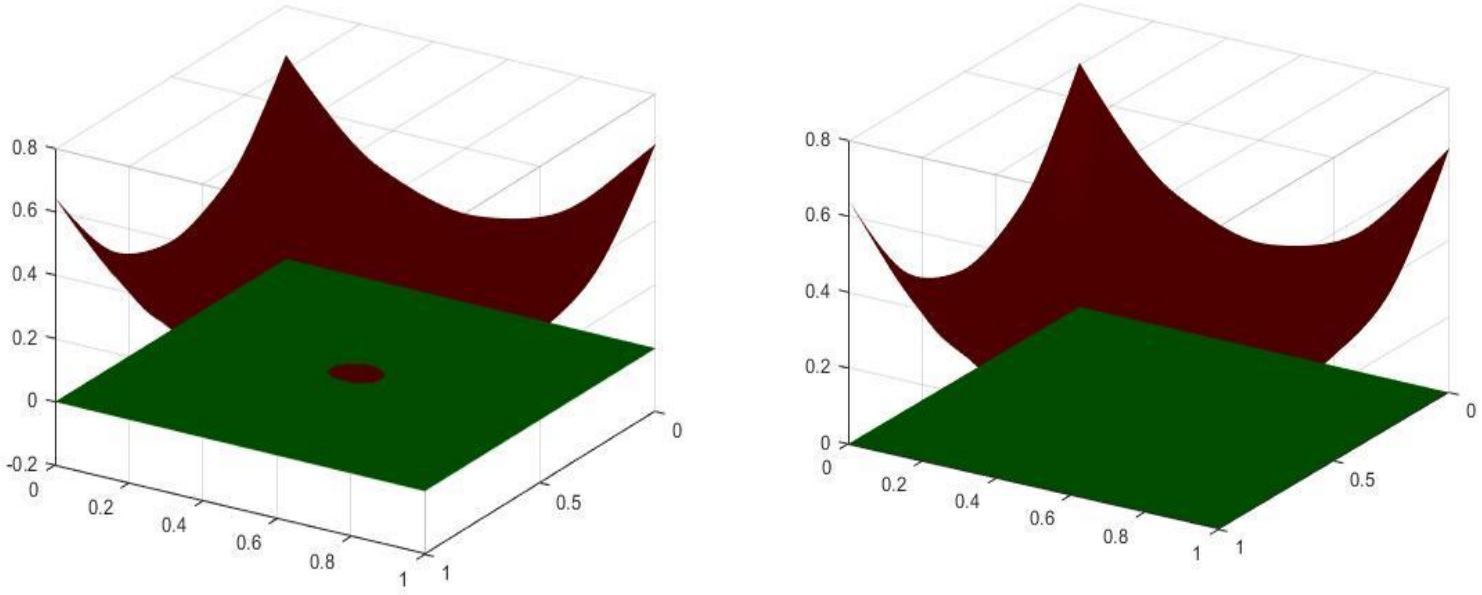


Figure 3: Delaunay triangulation for 36 scattered points (left) and resulting interpolating surface (right)



(a) Non-positivity surface (b) positivity preserving surface

Figure 4: Scattered data interpolation

Acknowledgement:

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