COS 702

Assignment 5

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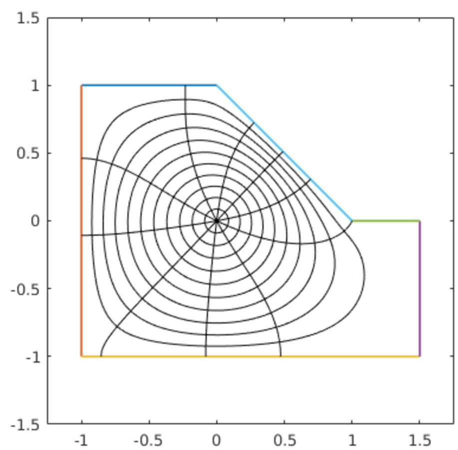
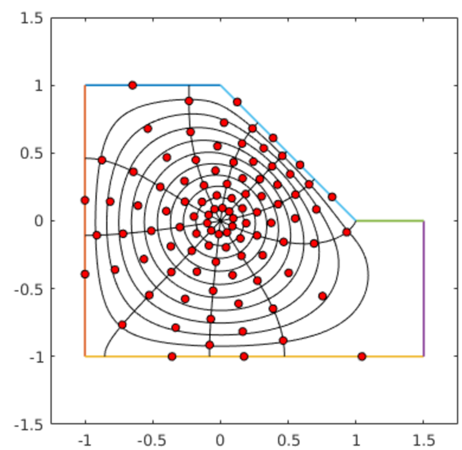
Introduction:

In this report, we will be reproducing the results from two papers. The first paper is titled "Radial Basis Function Interpolation on Irregular Domain through Conformal Transplantation". The second paper is titled "A matrix decomposition RBF algorithm: Approximation of functions and their derivatives. In this report, we will be reproducing the results from the first exercise in both papers.

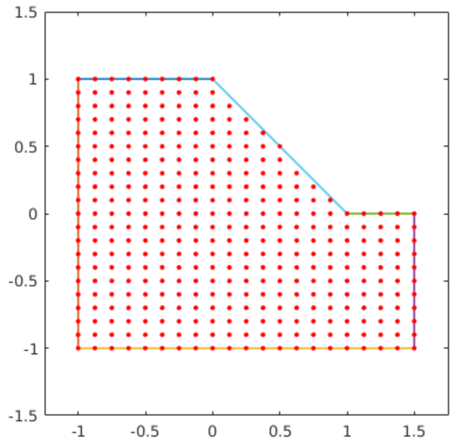
Paper 1 Method and Results:

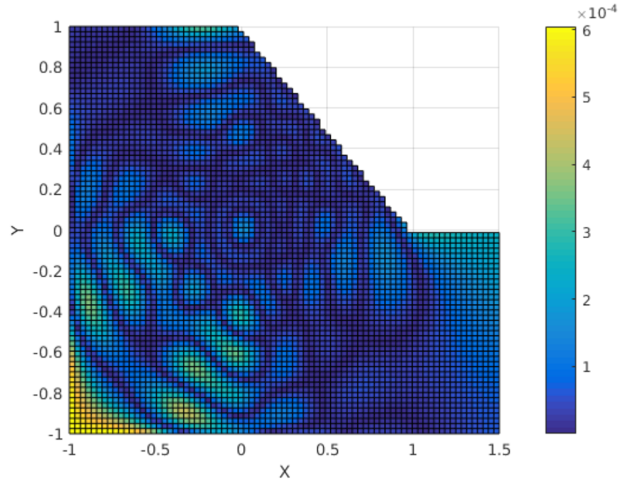
In the first paper, we are trying to interpolate functions on an irregularly shaped polygon. We can do this by mapping concentric circles inside the polygon, and placing the points at regular intervals along these circles. In the following images, we can see a demonstration of the concentric cirlces in the left image, and the points being mapped in the right image.





In these next images, we show the evaluation points and the error function plotted at m = n = 10 with 80x80 evaluation points.

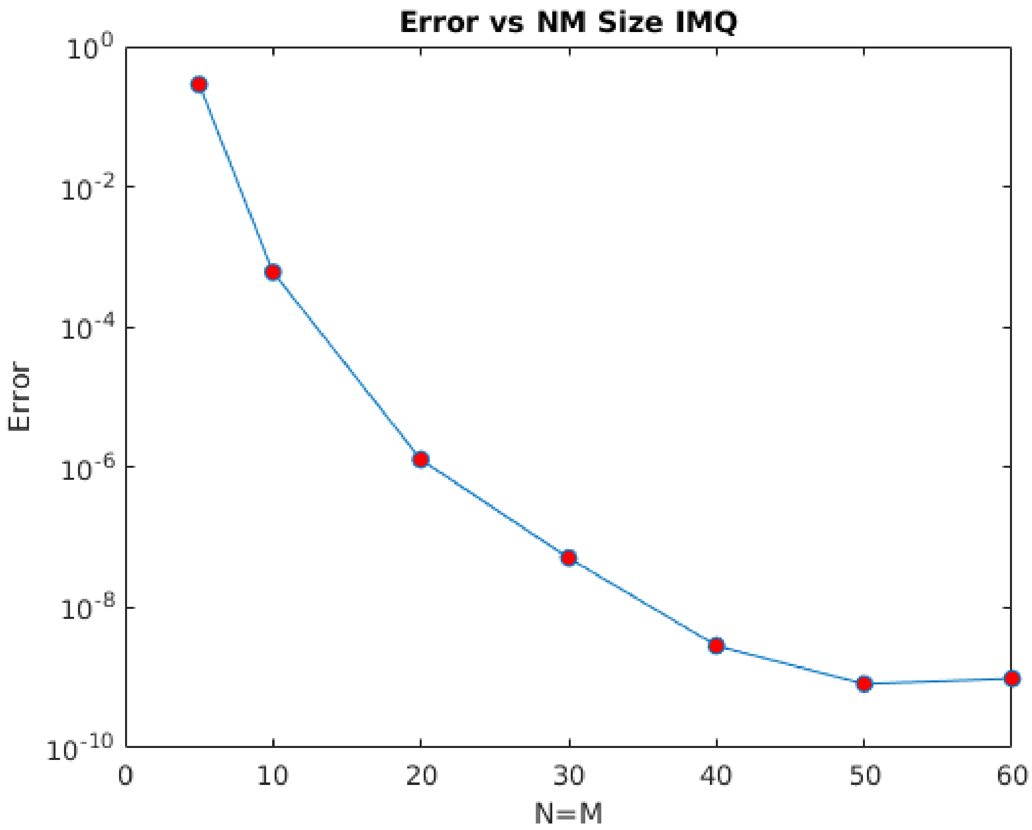




In the following tables, we have the error results for various m and n values and radial basis functions.

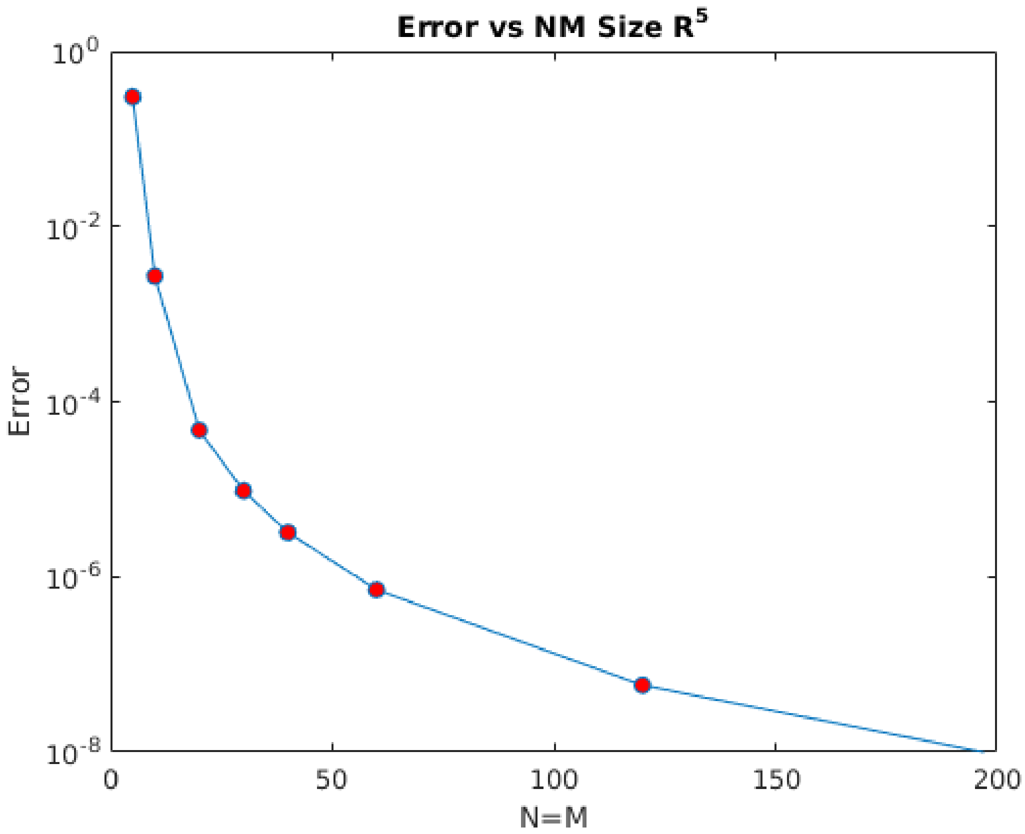
In the first table and graph, we use the inverse multi-quadratic radial basis function. It produces the following values and plots.

M	**N**	**Absolute Error**	**Time(s)**
5	5	2.87E-01	0.014
10	10	6.039E-04	0.006
20	20	1.286E-06	0.010
30	30	5.080E-08	0.022
40	40	2.856E-09	0.042
50	50	8.148E-10	0.079
60	60	9.715E-10	0.116



In the next table and graph, we use the r^5 radial basis function. It produces the following values and plots.

M	N	Absolute Error	Time(s)
5	5	3.018E-01	0.002
10	10	2.707E-03	0.003
20	20	4.720E-05	0.011
30	30	9.583E-06	0.028
40	40	3.209E-06	0.054
60	60	7.121E-07	0.151
120	120	5.782E-08	0.925
200	200	9.317E-09	3.794



Paper 2 Method and Results:

For paper 2, we will be using the same concentric circle technique as paper 1, but we will not be using an irregular polygon. I was unable to reproduce the complete results from the paper. I managed to get good results in the first section, but I couldn't get it to work for the rest of the paper. The following is my reproduction of table 3.

	m=n=80		m=n=100		m=n=120		m=n=140	
rmax	**0.75**	**1.0**	**0.75**	**1.0**	**0.75**	**1.0**	**0.75**	**1.0**
F1	5.2E-10	2.3E-13	1.1E-10	1.3E-12	1.8E-09	2.3E-11	8.3E-10	7.3E-13
F2	2.9E-07	4.2E-07	9.4E-09	1.7E-07	3.3E-09	1.1E-07	1.2E-09	3.6E-10
F3	7.2E-11	2.8E-12	3.7E-10	5.0E-11	6.1E-09	3.6E-09	6.8E-09	4.4E-11
F4	7.5E-12	2.6E-14	4.0E-11	1.8E-13	5.7E-10	3.9E-12	1.0E-09	9.0E-14
F5	1.3E-12	4.8E-13	7.0E-12	5.6E-14	1.1E-10	9.4E-13	1.5E-10	7.1E-14
F6	1.4E-08	7.2E-09	2.0E-08	1.8E-07	2.9E-07	7.3E-06	4.0E-07	1.5E-07