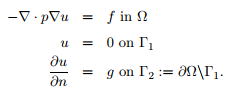
유한요소 Midterm Take Home Exam(2)

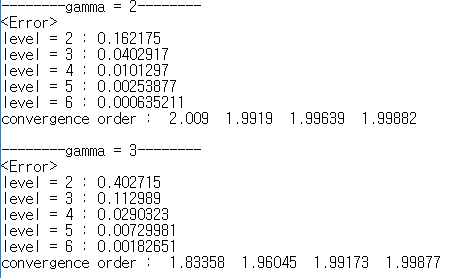
The problem is to solve a partial differential equation on an L-shape. Here, the equation is given as

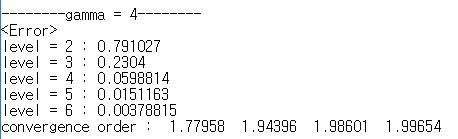


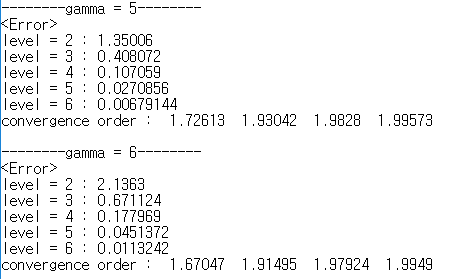
Here, u=, p=1+x+2 and g can be obtained by partial differentiating u. I tested the code for three cases when 1. is an positive integer, 2. and 3.

1. is a positive integer

Note that is is even, then u is infinitely differentiable. I tried some cases when . The result is as follow:



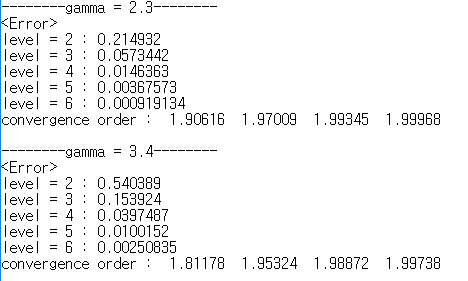


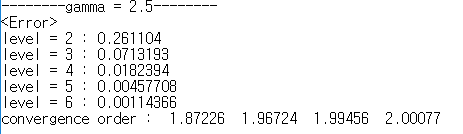


The result shows that every convergence order of each case goes to 2 as levels are increasing. Moreover, as gamma is increasing, the corresponding errors in low levels are too big to be ignore.

Note that if , then the gradient of u has no singularity in the domain, but if , then the gradient of u has a singularity at the origin. Thus I expected that the convergence order for may be near 2.

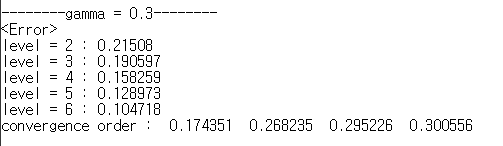
I tried some cases when =2.3, 3.4, 2.5.

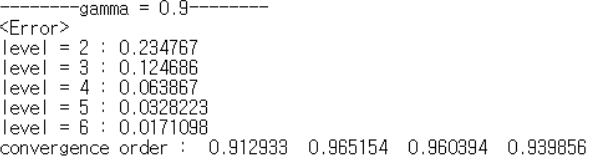


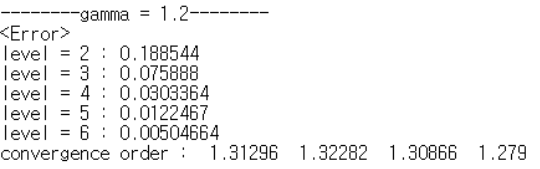


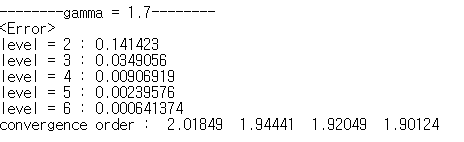
As I expected, each convergence order goes to 2 as levels are increasing.

At the first time when I tested in random, the convergence order does not go to 2 but it goes to near . Thus I tried 19 case when is k\*0.1 where k = 1, 2, ….., 19 to observe how the convergence orders change. Moreover, I plotted a graph about and the convergence order for the last level. The result for some cases is as follow:

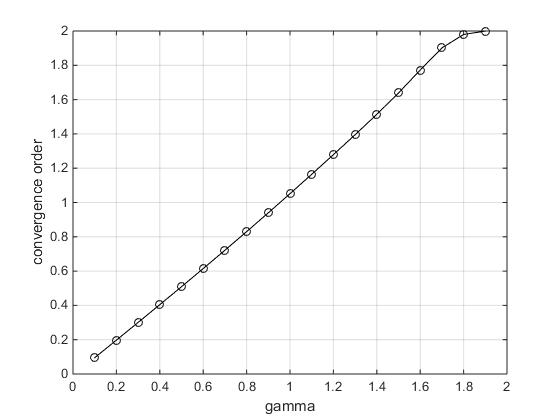








It seems that as is close to 2, the convergence order goes to 2 and when is sufficiently small, the convergence order is close to . The graph about and the convergence order is given by



1. Conclusion

If , then u is an function and so the convergence order is 2. If , then and where n= and -1<n<0. Thus u is not an function because these partial derivatives are not integrable near the origin. Thus the order of convergence is close to as the graph is shown.