

Finite Difference Method (FDM) and Finite Element Method (FEM)

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0.1 Introduction

Partial Differential Equation is For example is Heat Equations, Wave Equations, Elasticity Equations, Maxwell Equations, Navier-Stokes Equations, etc.

Because there are some PDEs that the analytical solution is not easy to get, we usually approach the solution by numerical method. For example is Boundary (Integral) Element Method, Particle Method, Spectral Method, Finite Difference Method (FDM) and Finite Element Method (FEM), etc. In this report, we will discuss about the comparison of FDM and FEM.

0.2 Finite Difference Method

0.3 Finite Element Method

0.4 Comparison

FDM

1. FDM is approximation of the differential operator by finite difference.
2. The function is approximated in grid points.
3. Difficult to apply for not rectangular domain.

FEM

1. The domain is approximated by triangular mesh.
2. Approximate the function space under variational structure.
3. Easy to apply for curved domain

As we can see, the FEM in two dimensional or three dimensional problem is much more powerful than FDM.