“A Dimension Splitting Method for 3D-PDEs”

Dr. Aixiang Huang
Xi’an Jiaotong University

Abstract

It is well-known that there exist many problems in numerical computation for three-dimensional nonlinear partial differential equations. For example, in solving 3D Navier-Stokes equations numerically, we need to consider the following difficulties:

1, Nonlinearity;

2, Incompressible constraint condition;

3, Complex boundary geometry;

4, Boundary layer.

In order to overcome the last two difficulties, we propose a dimension splitting method in which a three-dimensional complex flow problem is split into a series of two-dimensional sub-problems. The solution of the original 3D problem is then obtained by solving a nonlinear system with N 2D sub-problems. The method presented here is different from the classical domain decomposition method; we only need to solve a 2D sub-problem in each sub-domain without solving a 3D sub-problem. Numerical simulation for 3D rotating Navier-Stokes equations in turbomachinery will be reported to demonstrate the effectiveness of the proposed dimensional splitting method.