B-spline Based Finite Element Method for a Large scale ocean circulation

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ABSTRACT

This poster presents a B-spline based finite element method (FEM) for a large scale ocean circulation model. For physical model, we choose (one layer) quasi-geostrophic equations. Quasi-geostrophic equation is a popular model for large scale ocean circulation. This model is 4th order nonlinear partial differential equations (PDE). Its simplicity gives computational efficiency in numerical simulation without losing ocean's low-frequency behavior. For spatial discretization, we used B-spline based FEM. B-spline has good approximation property and it is smooth enough to apply for the discretization of 4th order PDE. The difficulty of the B-spline based FEM is that it is not interpolatory. Hence, it is difficult to impose the essential boundary condition such as Dirichlet boundary condition. To overcome this difficulty, we employed Nitsche's method which impose the boundary condition weakly by penalty terms. 3 different types of formulations (symmetric, non-symmetric, incomplete) are concerned. Symmetric formulation shows optimal convergence from L^2 to H^2 norms with usual penalty. Optimal convergence rates for other two formulations are observed after applying super penalty parameters.

REFERENCES

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