國立中央大學數學系
專題演講

主講人：Prof. Huoyuan Duan (Wuhan University)

題目：Fortin interpolation of piecewise non H1 space solution, edge element and adaptive algorithm of double curl problem with divergence free constraint

演講茶會：2014 年 6 月 19 日(星期四) 2:30 P.m. ~ 3:00 P.m.(地點:鴻經館 M306 教休室)

演講時間：2014 年 6 月 19 日(星期四) 3:00 P.m. ~ 4:00 P.m.

演講地點：中央大學鴻經館M 107室

Abstract:

A new theory is developed for Fortin interpolation of H(curl)-conforming elements, aiming at very weak solution with *piecewise* non H1 space regularity in the solution itself and its curl. The non H1 space regularity is typically due to irregular domain boundary and discontinuous anisotropic and inhomogeneous media. When compared with the earlier theory, the significant findings feature several aspects. The Fortin interpolation is suitable for piecewise and very low regular function with non H1 space regularity. The technique is new, with the multiple application of the regular-singular decomposition. Optimal error bounds are established for piecewise non H1 space solutions. Discrete compactness is also shown in the application of the new theory to Maxwell eigenvalue problem. When compared with the so-called co-chain bounded projection, the Fortin interpolation we have developed is suitable for piecewise non H1 space solutions which typically live in discontinuous, anisotropic and inhomogeneous media. Another important advantage is the Fortin interpolation preserves the discrete divergence. These points are not possessed by the co-chain bounded projection. As an application, we consider the recently developed delta-regularization edge or Nedelec element method with a small parameter delta for the double curl problem with divergence-free constraint. The problem is posed in discontinuous, anisotropic and inhomogeneous media. With the help of the Fortin interpolation, uniform in the parameter delta, optimal error convergence of the resultant finite element solution is shown. A series of numerical experiments are performed to illustrate the theoretical results. In addition, adaptive algorithms are developed. An analysis is carried out and the convergence and the optimality are obtained, uniformly with respect to the parameter delta. Likewise, the Fortin interpolation developed plays a key role in the analysis. Numerical results are presented to confirm the convergence and the optimality of the adaptive algorithm.

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