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Dongwoo Sheen* (sheen@snu.ac.kr), Department of Mathematics, Seoul National University, Seoul, 151-747, South Korea, **Taeyoung Ha** (tyha@snu.ac.kr), Department of Mathematics, Seoul National University, Seoul, 151-747, South Korea, and **Kitak Lee** (klee@nasc.snu.ac.kr), 707-19, Yoksam 2-Dong, Gangnam-Gu, Seoul, 135-918, South Korea. *Dispersion analysis of nonconforming finite element methods for the Helmholtz equation.*

We present a priori error estimates and analyze the numerical dispersion relation of some conforming and nonconforming quadrilateral finite elements. The elements employed in this analysis are the standard Q_1 conforming finite element, the DSSY nonconforming element introduced by Douglas-Santos-Sheen-Ye in 1999 [1,2], and the P_1 -nonconforming quadrilateral finite element introduced in [3]. Several aspects of comparative analyses of the above three elements in two or three dimensional problems are shown.

[1] J. Douglas Jr., J. E. Santos, D. Sheen, and X. Ye. Nonconforming Galerkin methods based on quadrilateral elements for second order elliptic problems. *ESAIM-Math. Model. Numer. Anal.*, 33(4):747–770, 1999.

[2] J. Douglas Jr., J. E. Santos, and D. Sheen. Nonconforming Galerkin methods for a Helmholtz problem. *Numer. Methods Partial Differential Equations*, 17(5):475–494, 2001.

[3] C. Park and D. Sheen. P_1 -nonconforming quadrilateral finite element methods for second-order elliptic problems. *SIAM J. Numer. Anal.*, 41(2):624–640, 2003. (Received September 25, 2006)