This is a review text file submitted electronically to MR.

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Short title: Superconvergent biquadratic finite volume element method for two-dimensional Poisson's equations.

MR Number: 2606688

Primary classification: 65N08

Secondary classification(s): 65N15; 65N12; 35J05; 65N30

Review text:

The authors consider the biquadratic finite volume element approximation for the Poisson's equation on the rectangular domain $\Omega = (0,1)^2$. The primal mesh is performed using a ractangular partition. The control volumes are chosen in such a way that the vertices are stress points of the primal mesh. In order to solve the scheme more efficiently, the authors wrote the biquadratic finite volume element scheme as a tensor product form and used the alternating direction technique to solve it.

Thanks to the fact that the primal mesh satisfies a superconvergence property in the interpolatory approximation, the authors prove that the numerical gradients of the method have h^3–superconvergence order at optimal stress points. Using the dual argument technique, the authors also prove that the convergence order in L^2–norm is h^4 at nodal points. A numerical example is presented to support the theoretical results