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The eigenvalue problem of the Uzawa pressure operator

Knowledge about the spectrum of the Uzawa pressure operator, defined by $S := \nabla \cdot \Delta^{-1} \nabla$, is important for solving and performing an error analysis of the Stokes problem. The infimum of the spectrum of the Uzawa pressure operator, denoted by $\lambda_{\min}(S)$, is significant, for instance, it gives information about the rate of convergence of numerical methods for the Stokes problem. The spectrum of the Uzawa pressure operator is still not known for the case of a square domain. This talk describes some results related to this problem. It depicts the efforts made for estimating $\lambda_{\min}(S)$ for a square domain. In 1996, M. Gaultier and M. Lezaun gave an upper bound equal to 0.2260 for $\lambda_{\min}(S)$, we have improved it to 0.20164. We conjecture that $\lambda_{\min}(S) = \frac{1}{2} - \frac{1}{\pi} \approx 0.18169$ for a square domain.