STABLE FE METHODS FOR CHALLENGING PROBLEMS IN ENGINEERING AND SCIENCE

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For a large class of partial differential equations (PDEs) arising in engineering science, e.g., singular perturbation, Helmholtz, nearly incompressible elastostatics problems, and coupled problems, the corresponding finite element (FE) discretizations suffer from a loss of stability. Certain FE discretizations provide relief from the loss of stability by constructing FE approximations of the corresponding weak formulation to the PDE that satisfies the discrete inf-sup condition. Furthermore, recent work in data-driven methods can also be incorporated to develop stable FE schemes. To create discussions around these issues, we invite contributions with a focus on the following:

- Stable discretization schemes for stationary and transient linear and non-linear problems.
- Residual minimization techniques such as the least squares FE method and the discontinuous Petrov-Galerkin method and their analysis.
- *A posteriori* error analyses and estimates for stable discretization schemes leading to error indicators and adaptive mesh refinement strategies.
- Development of new FE basis functions leading to stable schemes.
- Implementational aspects and issues surrounding stable FE methods in modeling physical phenomena.
- Development of solvers for the linear system of equations resulting from stable discretization schemes.
- Application of stable FE methods to large-scale, complex problems in engineering science.
- Integration of data-driven techniques with FE technology.