An analysis of high-frequency Helmholtz problems in domains with conical points and their finite element discretization

Serge Nicaise[1]   Théophile Chaumont-Frelet[2]

We consider Helmholtz problems in three-dimensional domains featuring conincal points. We focus on the high-frequency regime and derive novel sharp upper-bounds for the stress intensity factors of the singularities associated with the conical points. We then employ these new estimates to analyze the stability of finite element discretizations. Our key result is that lowest-order Lagrange finite elements are stable under the assumption that "$\omega^2 h$ is small". This assumption is standard and well-known in the case of smooth domains, and we show that it naturally extends to domain with conical points, even when using uniform meshes.

[1]Univ. Polytechnique Hauts-de-France, Céramaths/Département de Mathématiques, Valenciennes, France
  `Serge.Nicaise@uphf.fr`

[2]Inria Université Côte D'Azur, Nice, France
  `theophile.chaumont@inria.fr`