Recent results on the stability of the non-symmetric coupling of finite and boundary elements

Matteo Ferrari[a]

[a] Dipartimento di Scienze Matematiche, Politecnico di Torino (Italy)
matteo.ferrari@polito.it

We consider the non-symmetric coupling of finite and boundary elements to solve second order uniform elliptic partial differential equations defined in unbounded domains. We present a novel condition that ensures the ellipticity of the associated bilinear form, keeping track of its dependence on the linear combination coefficients of the interior domain equation with the boundary integral one. We show that an optimal ellipticity condition, relating the minimal eigenvalue of the diffusion matrix to the contraction constant of the shifted double-layer integral operator, is guaranteed by choosing a particular linear combination. This latter condition is always satisfied when the interface is a circle. These results generalize those obtained in Of and Steinbach [2] and [3], and in Steinbach [4] where the simple sum of the two coupling equations has been considered. Numerical examples confirm the theoretical results on the sharpness of the presented estimates.

References

[1] M. Ferrari, *Developments on the stability of the non-symmetric coupling of finite and boundary elements*, submitted.

[2] G. Of and O. Steinbach, *Is the one-equation coupling of finite and boundary element methods always stable?* ZAMM Z. Angew. Math. Mech. 93 (2013), pp. 476–484.

[3] G. Of and O. Steinbach, *On the ellipticity of coupled finite element and one-equation boundary element methods for boundary value problems*, Numer. Math. 127 (2014), pp. 567–593

[4] O. Steinbach, *A note on the stable one-equation coupling of finite and boundary elements*, SIAM J. Numer. Anal. 49 (2011), pp. 1521–1531.