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EFFICIENT MESH DEFORMATION BASED ON RANDOMIZED RBF SOLVERS

W. Bader[1,2,*], A. Parret-Fréaud[2], S. Da Veiga[2] and Y. Mesri[1]

[1] CEMEF – Centre for material forming, MINES ParisTech, PSL, CNRS UMR 7635, 06904 Sophia-Antipolis, France, {wael.bader,youssef.mesri}@mines-paristech.fr
[2] Safran Tech, Rue des Jeunes Bois, Chateaufort, 78114 Magny-Les-Hameaux, France, {wael.bader,augustin.parret-freaud,sebastien.da-veiga}@safrangroup.com

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Mesh deformation methods have been widely used for the past decades in various fields such as fluid-structure interaction, aerodynamic shape optimization, unsteady and aeroelastic computational fluid dynamics. Among the existing methods, radial basis functions interpolation (RBF) [1] is particularly suitable for unstructured mesh applications due to its simplicity and the high quality of the resulting mesh. Such approach requires solving dense linear systems, generally symmetric positive definite (SPD), which tends to be computationally expensive and memory demanding, which is a major drawback when dealing with large-scale meshes [2, 3].

In this work, we aim to speed-up RBF mesh deformation procedure using methods coming from probabilistic linear algebra to solve the associated dense linear system. Indeed, such methods start to emerge into several fields, including numerical linear algebra and optimization [4], exploiting its spectral properties as an efficient alternative to reduce the complexity of solving large scale linear system. We will address the question of how to create an approximation to the RBF matrix by projecting the initial large scale operator onto a smaller subspace that exhibits specific properties such as a better sparsity and investigate various solving strategies.

The proposed approach will be discussed on the basis of $2D$ and $3D$ applications.

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