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Outlier-free isogeometric discretizations

Carla Manni[1], Espen Sande[2*] and Hendrik Speleers[3]

[1] University of Rome Tor Vergata, Rome, Italy, manni@mat.uniroma2.it
[2] EPFL, Lausanne, Switzerland, espen.sande@epfl.ch
[3] University of Rome Tor Vergata, Rome, Italy, speleers@mat.uniroma2.it

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The isogeometric approach for eigenvalue problems has been widely investigated in the literature and maximally smooth spline spaces on uniform grids are an excellent choice for addressing eigenvalue problems. Yet, they still present a flaw: a very small portion of the eigenvalues are poorly approximated and the corresponding computed values are much larger than the exact ones. These spurious values are usually referred to as outliers.

Outlier-free discretizations are appealing, not only for their superior description of the spectrum of the continuous operator, but also for their beneficial effects in various contexts, such as an efficient selection of time-steps in (explicit) dynamics. For a fixed degree, the challenge is to remove outliers without loss of accuracy in the approximation of all eigenfunctions.

In this talk we discuss isogeometric Galerkin discretizations of eigenvalue problems related to the Laplace operator subject to any standard type of homogeneous boundary conditions using the optimal spline subspaces of [1]. For a fixed number of degrees of freedom, all the eigenfunctions and the corresponding eigenvalues are well approximated, without loss of accuracy in the whole spectrum when compared to the full spline space [2, 3]. Moreover, there are no spurious values in the approximated spectrum. In other words, the considered subspaces provide accurate outlier-free discretizations.

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