

# MUMPS-BLR inside a preconditioned eigensolver

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## Abstract

Sparse direct solvers are ubiquitous at Ansys. They are used in a wide range of applications, like structural mechanics, fluid flows, electromagnetism, circuit simulations, etc. Even though we have in-house multifrontal codes, we have adopted MUMPS for a few different applications. Of particular interest to us is the Block Low-Rank (BLR) mode that MUMPS offers. We use it for applications that rely on iterative solvers (e.g., external aerodynamics), and we have recently started using it inside a preconditioned eigensolver, LOBPCG (Locally Optimal Block Preconditioned Conjugate Gradient [Knyazev 2001]). In some situations, analysts only want to compute a handful of eigenmodes but require strong accuracy guarantees. In other configurations, like Noise-Vibration-Harshness (NVH), analysts may compute thousands of modes but require only a few digits of accuracy. In this context, having a tunable preconditioner like MUMPS-BLR is particularly interesting. In this talk, we'll illustrate how we use MUMPS-BLR inside LOBPCG and we'll show results for different applications.