

# Leveraging MUMPS to enhance performance of Altair Solvers

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## Abstract

In this presentation, we will explore the use of MUMPS, a powerful and efficient sparse linear solver, in several Altair solvers used for numerical simulations.

We will examine the performance and robustness of MUMPS in the context of diverse industrial applications, as well as recent improvements that have enabled faster simulations using GPUs.

Specifically, we will discuss the application of MUMPS in four leading Altair solvers: OptiStruct, Feko, Flux and Radioss. In OptiStruct, MUMPS is seamlessly integrated to solve both linear and nonlinear problems in structural analysis and optimization. So-called "Block Low Rank" (BLR) is efficiently used to compute preconditioners with MUMPS for Feko's hybrid solvers that employ sparse algebraic methods, such as the Multilevel Fast Multipole Method and the Finite Element Method, to solve electromagnetic problems. We will also explore the use of MUMPS in Flux, a reference solver for multiphysics simulations in magnetic, electric and thermal, and in Radioss, an industry leader for crash, safety and impacts, that relies on MUMPS for some specific implicit computations such as spring back in forming simulation.

We will highlight the performance improvements achieved by using MUMPS in these applications, including memory reduction and faster time to solution. We will also discuss some of the challenges that arise when using MUMPS in large-scale simulations.

Overall, this presentation will provide an overview of diverse industrial applications of MUMPS, and demonstrate the benefits that can be achieved by leveraging this powerful solver technology.