



PROGRAMME
DE RECHERCHE
NUMÉRIQUE
POUR L'EXASCALE

WP4 : Parallel solution of the NEG function and a Selected Inverse problem

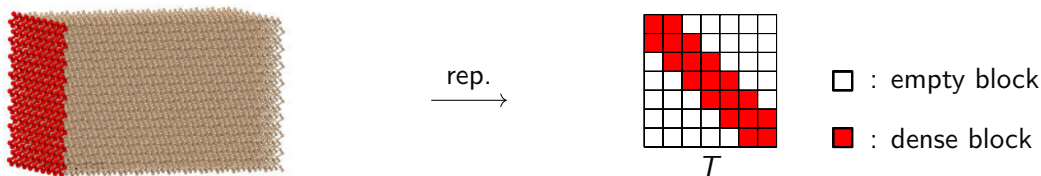
Emmanuel Agullo, Alfredo Buttari, **Matthieu Robeyns**

September 22, 2025

IRIT - CNRS - Inria

Introduction

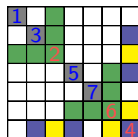
- Who am I ? → Matthieu Robeyns, postdoctoral researcher.
- Work Package : EoCoE-III (WP2–Materials)
⇒ NumPEX WP4 : Task-based numerical building blocks.
- Materials : Compute the inverse of T by using **Selected Inverse¹** (SI) algorithm.



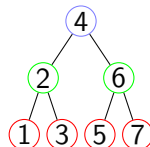
¹SelfInv—An Algorithm for Selected Inversion of a Sparse Symmetric Matrix, 2011

Nested Dissection

■ : Dense block □ : Zeros block ■ : Fill-in block



dependency's graph



- **Nested-dissection**²: Recursively reordering the matrix.



Increase the degree of parallelism.



Add **fill-in** effect $\Rightarrow$ increase the computation cost.

Goal : Find the **good trade-off** between **fill-in** and **parallelization**.

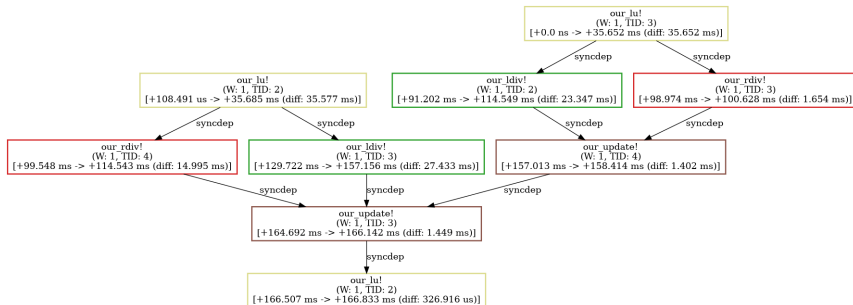
Idea : Use **task-based model** (Consider line computation as **task**).

²Nested dissection of a regular finite element mesh, A George, 1973

Implementation



- Execution of **independent** tasks can be done in parallel.
- Represented as Directed Acyclic Graph (DAG), where :
 - nodes = task (elementary operation),
 - edges = dependencies.
 - **Sequential task flow (STF)** : automatically generate the DAG of task and schedule task to be execute at the runtime. (Example : Dagger)



THANK YOU!
Questions?

¹SellInv—An Algorithm for Selected Inversion of a Sparse Symmetric Matrix, 2011

²Nested dissection of a regular finite element mesh, A George, 1973