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ExaQUte

Exascale **Q**uantification of **U**ncertainties for **Te**chnology and Science Simulation

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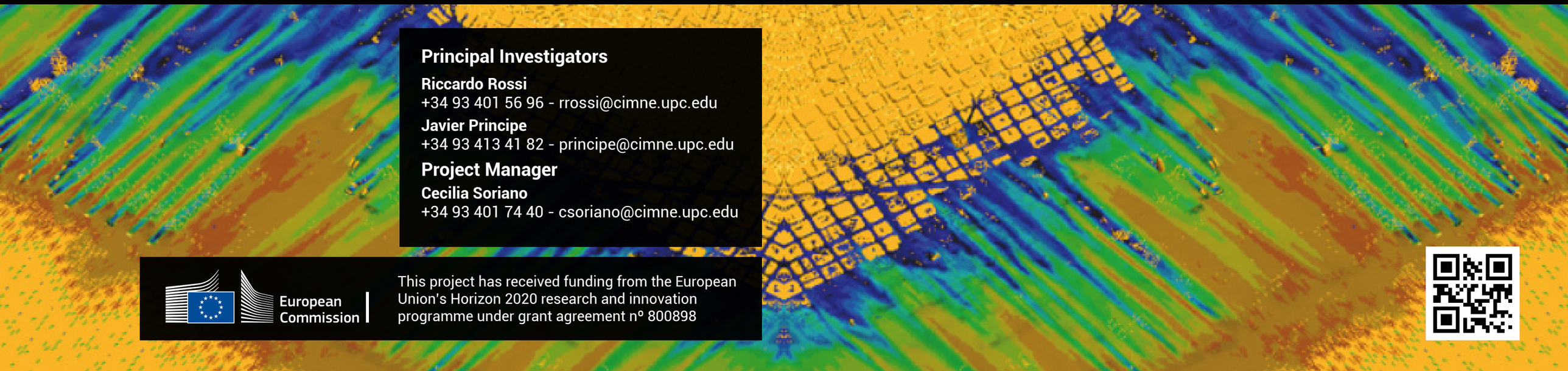

Principal Investigators

Riccardo Rossi
+34 93 401 56 96 - rrossi@cimne.upc.edu

Javier Principe
+34 93 413 41 82 - principe@cimne.upc.edu

Project Manager

Cecilia Soriano
+34 93 401 74 40 - csoriano@cimne.upc.edu

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The ExaQUte project aims at constructing a framework to enable Uncertainty Quantification (UQ) and Optimization Under Uncertainties (OUU) in complex engineering problems using computational simulations on Exascale systems.

The stochastic problem of quantifying uncertainties will be tackled by using a Multi Level MonteCarlo (MLMC) approach that allows a high number of stochastic variables. New theoretical developments will be carried out to enable its combination with adaptive mesh refinement, considering both, octree-based and anisotropic mesh adaptation.

What?

Develop new computational methods and software tools.

Why?

To target Uncertainty Quantification and Optimization Under Uncertainties for Multiphysics and multiscale problems on geometrically complex domains.

How?

Taking advantage of next-generation Exascale systems.

Goals

1. Develop a scheduling tool to extract parallelism in the MLMC algorithm across samples and levels.
2. Develop embedded solvers for multiphysics problems.
3. Develop parallel adaptive refinement methods for embedded domains.
4. Develop space-time methods for the numerical simulation of multiphysics problems.
5. Extend the MLMC to use an adaptively refined space-time mesh hierarchy.
6. Combine MLMC methods with gradient-based optimization techniques based on adjoint problems.

Application

Shape optimization of civil engineering structures subjected to wind flow.

ExaQUte

WP9 ExaQUte Project Management

WP1 Embedded methods

WP2 Mesh generation & Adaptivity

WP3 Space-time parallelization

WP4 Scheduling for MLMC

WP5 Algorithmic extensions of MLMC (UQ)

WP6 Optimization under uncertainties

WP7 Application to robust shape optimization of structures under wind loads

WP8 ExaQUte Dissemination and Exploitation