Scientific activity

The main scientific interests concern on one hand the mathematical and numerical modeling of the mechanics of porous media in both saturated and unsaturated conditions with specific applications in subsurface hydrology and petroleum industry, on the other the numerical linear algebra. His main activity is the development and implementation of numerical models based on the Finite Element method for the simulation of subsurface coupled and uncoupled geomechanical and fluid dynamical processes in the exploitation of deep aquifer or reservoir resources. As to the linear algebra, Carlo Janna studies and develops numerical techniques for the solution of large sparse linear systems and eigenproblems and more specifically iterative methods and preconditioners. For sequential computers, he studied and developed several ad hoc preconditioners for the solution to specific problems arising in subsurface simulations. From 2010 to 2012, Carlo Janna joined the HPC research projects PARP- SEA (PARallel Preconditioners for large Size Engineering Applications), SCALPREC (SCALable PREConditioners), OPTIDAS (OPTImization and Data ASSimilation) and SPREAD (Scalable PREconditioners for Advanced Discretizations) studying and developing new preconditioners for mas- sively parallel computers. Currently, he is working in a project funded by the Italian oil company ENI whose goal is to develop effective preconditioners for the GPUs.