

MACOPA: a free software toolkit for the simulation of multi-physic, multi-scale transport problems based on asynchronous time integration

Time consistent numerical integration of transport partial differential equations systems can be done with fully local time stepping at the cell level in a explicit formalism with the so-called "asynchronous" time integration methods. Large speed-up can be achieved for multi-scale problems. Different numerical schemes have been developed within the MACOPA free software toolkit: finite volume schemes, discontinuous Galerkin schemes, distributed residual schemes. Higher order time accuracy could also be achieved when using specific Asynchronous Runge-Kutta methods. Parallelization of the asynchronous schemes will also be discussed.

Some simulation results in combustion, electromagnetism, discharge plasmas and coupled problems will be shown.