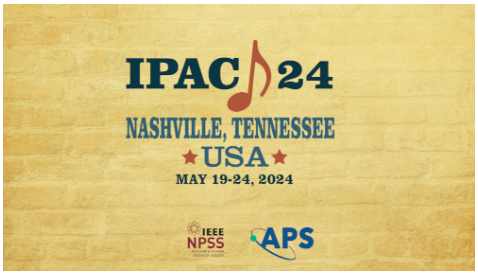

Contribution ID: **1953** Contribution code: **MOPS28** Type: **Poster Presentation**

Progress of the nonlinear time-domain finite element solver implementation in the electromagnetic code ACE3P

Monday, 20 May 2024 16:00 (2 hours)

SLAC has developed the parallel finite element electromagnetics simulation suite ACE3P which employs the parallel high-order finite element (FE) method to solve Maxwell's equations at the macroscopic level. Under the support of an SLAC LDRD, optical nonlinearities in the transient regime have been incorporated into the ACE3P time-domain solver for the investigation of nonlinear physical processes such as harmonic generation, parametric processes and electro-optic effects. This nonlinearity will be applied to provide high fidelity modeling capability to quantum frequency converters employing nonlinear materials in quantum information science applications. The new solver has been benchmarked against the commercial solver ANSYS Lumerical. Furthermore, we have completed the first prototype of the new nonlinear solver employing PETSc, a powerful suite of data-structure-neutral scalable numerical routines for large-scale linear and nonlinear problems. The PETSc library and the Scalable Nonlinear Equations Solvers (SNES) components include backend CPU/GPU implementations thus offering the needed numerical methods for solving Maxwell's equations with nonlinearities.

Footnotes

Funding Agency

Paper preparation format

Region represented

North America

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Session Classification: Monday Poster Session

Track Classification: MC5: Beam Dynamics and EM Fields: MC5.D03 Calculations of EM fields Theory and Code Developments