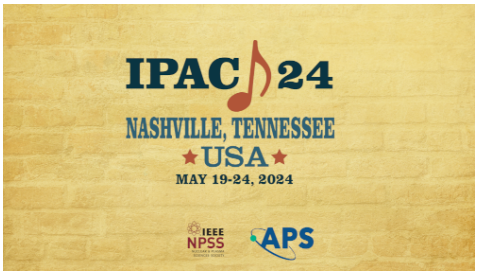

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Impedance calculation for large accelerator structures using a domain decomposition method

Thursday, 23 May 2024 16:00 (2 hours)

The beam coupling impedance is a key design parameter for all accelerator structures. Recently, we have introduced a novel simulation approach for impedance calculations in 3D-geometry. Unlike conventional methods, this approach is based on the solution of Maxwell's equations in the frequency domain using a high-order finite element technique. The main challenge for all impedance simulations, however, is the huge amount of computational resources that is required for the numerical discretization of electromagnetically large accelerator structures.
In this contribution, we introduce a specialized domain decomposition technique for impedance simulations. The technique allows to handle large accelerator structures by decomposing the computational domain into subdomains that interact by means of suitably chosen boundary conditions. We describe a class of such boundary conditions that accurately take into account the modal wave contributions traveling through domain interfaces in the presence of a particle beam. An application of the method considered in the paper is the full impedance characterization of a large in-vacuum undulator for the PETRA IV synchrotron source.

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