Keynote Talk: Upgrading Synchroton Light Sources with COMSOL Server™

N. Goldring[1]

[1]RadiaSoft, LLC., Boulder, CO, USA

Abstract

Next-generation synchrotron light sources are creating orders-of-magnitude brighter X-rays by reducing horizontal emittance. This requires the bending magnet pole tips to be closer to the electron beam axis, which in turn requires smaller vacuum chambers. The resultant design challenges are dictated by complex and coupled physical phenomena, including high thermal stresses, photon-stimulated desorption, and electromagnetic wakefields. The Application Builder in the COMSOL Multiphysics software enables the creation of browser-based graphical user interfaces (GUIs), which enable scientists and engineers to study this complicated problem domain without becoming an expert user of the COMSOL software. With a relatively inexpensive COMSOL Server™ product license, these GUIs can be run on a cloud-based server, with many processors and all of the required RAM for complex simulations. This approach extends the power of COMSOL Multiphysics to collaborators, customers, students, etc. We present two such GUIs: 1) the emission of synchrotron radiation and resultant thermal stress on vacuum chamber walls that are downstream of dipole bending sections, and 2) accurate thermal analysis and optimized mechanical bending correction for high-heat-load beamline mirrors. The various challenges of creating the underlying FEA models and the methods used to overcome them will be discussed. Both examples are relevant to the Advanced Photon Source upgrade (APS-U) under construction at Argonne National Laboratory.