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## Finite Element Simulation of Fast Corrector Magnets for PETRA IV

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The new synchrotron light source PETRA IV at DESY will use a fast orbit feedback system with hundreds of fast corrector magnets to meet stringent orbit stability requirements. These magnets are operated at high frequencies, creating strong eddy currents that result in Joule losses and a time delay between applied voltage and aperture field. User experiments impose challenging requirements on beam operation to preserve the point of the radiation source. To meet the demanding feedback requirements, finite element simulations are needed to understand the characteristics of the corrector magnet. However, due to the small skin depths at high frequencies and the laminated structure of the yoke, these simulations need a very fine mesh and are thus very costly. Therefore, we homogenize the laminated yoke which reduces the computational effort but captures the eddy current effects accurately. The reduction of simulation times from several hours to a few minutes allows us to conduct extensive studies of the eddy current losses, the multipole coefficients, and the transfer functions of the magnets.

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