In this work we present a simulation of a synchronous generator with superconducting rotor windings. As many other, electrical rotating machines, superconducting generators are exposed to ripple fields that could be produced from a wide variety of sources: short circuit, load change, mechanical torque fluctuations, etc. Unlike regular conductors, superconductors, experience high losses when exposed to AC fields. Thus, calculation of such losses is relevant for machine design to avoid quenches and increase performance. Superconducting coated conductors are well known to exhibit nonlinear resistivity, thus making the computation of heating losses a cumbersome task. Furthermore, the high aspect ratio of the superconducting materials involved adds a penalty in the time required to perform simulations.

The chosen strategy for simulation is as follows: A mechanical torque signal together with an electric load is used to drive the finite element model of a synchronous generator where the current distribution in the rotor windings is assumed uniform. Then, a second finite element model for the superconducting material is linked to calculate the actual current distribution in the windings of the rotor. Finally, heating losses are computed as a response to the electric load. The model is used to evaluate the transient response of the generator.