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Thu-Mo-Po4.07-04 [49]: A simplified electromagnetic modelling of accelerator magnets wound with Conductor on Round Core wires for ac loss calculations

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Conductor on Round Core (CORC(R)) wires are attractive for applications to accelerator magnets because of their large current capacity and mechanical flexibility. Because accelerator magnets are sometimes required to generate time-dependent magnetic field, ac losses and their distributions in the magnets can be problems. Because coated conductors composing CORC(R) wires have three-dimensional geometry, calculations of ac losses of coated conductors in CORC(R) wires composing accelerator magnets are quite difficult.
In order to calculate ac losses in magnets wound with CORC(R) wires, we develop simple three-dimensional electromagnetic field analysis model. In our model, at first, magnetic field seen by a cross section of a CORC(R) wire is calculated with simple three-dimensional geometry approximation. Here, instead of exact current distributions in the CORC(R) wires composing the magnet, uniform current distribution in cross sections of the three-dimensionally wound CORC(R) wires in the magnets are assumed. Second, three-dimensional magnetic field distribution in coated conductors composing the single CORC(R) wire is calculated from the two-dimensional magnetic field distribution at the cross section of the CORC(R) wire. Here, the calculated magnetic field distribution in the cross section of the CORC(R) wire is assumed as uniform along longitudinal direction of the CORC(R) wire. Third, three-dimensional electromagnetic field analysis is conducted for the CORC(R) wire, and the ac loss is calculated.
We apply this model to a magnet for a rapid cycling synchrotron. The magnet contains HTS deformed race-track coils wound with 6-strand CORC(R) wires and an iron yoke. The ac loss distributions at some different parts of the magnet are discussed based on the calculated magnetic field and current density distributions in the cross sections of the CORC(R) wires

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