Conclusion

In these thesis a general technique for the numerical solution of the field problem relative to large scale superconducting devices is developed. The definition of the field problem, which is assumed to be temperature independent, can be based both on the assumption of the E-J power law and the B-H hysteretic curve as constitutive relation of the superconducting material, by using the **A**-φ formulation of magnetoquasistatics and the Clebsh decomposition of the magnetic field respectively. The most general case which can be solved by means of the developed numerical method is the current distribution inside superconducting bulks interacting with magnetizable domains and a voltage driven normal conducting coil; such a system can schematize a large number of practical superconducting devices.

The field equations are discretized by means of an integral formulation, which allows to associate an equivalent circuit to the considered device. The equivalent circuit can be used to carry out the accurate field analysis inside the device, which are usually required in the design phase. Moreover, with reference only to the numerical convergence of some integral quantities, the equivalent circuit can be simplified and exported to a power system simulator to study the device/system interaction.

By means of the model the equivalent circuit of a magnetic shield type fault current limiter is derived. The validation through experimental data shows a good accuracy of the numerical results. The equivalent circuit is seen to reduce to the equivalent circuits available in the technical literature for particular geometries of the device. When the equivalence does not hold, the accuracy of the present equivalent circuit is greater.