

Numerical Modeling of HTS Applications

Francesco Grilli

Karlsruhe Institute of Technology, Karlsruhe, Germany

E-mail: francesco.grilli@kit.edu

Abstract — High-temperature superconductor (HTS) applications have reached a mature status, with several prototypes and devices in pre-commercial stage installed around the world. Following this development, numerical models able to simulate their electromagnetic and thermal behavior have become indispensable tools to improve their design and predict their performance. In this contribution, I show how numerical models have evolved from simple models able to calculate the current distribution in one individual tape to powerful instruments able to simulate complex geometries, material properties and operating conditions. Then, I focus on the state-of-the-art of numerical modeling of specific applications, such as cables, magnets, and electrical machines. Finally, I indicate the challenges that are still open and the possibility of establishing a collective effort to speed-up the advance of this important research topic.

Keywords (Index Terms) — Numerical modeling, HTS applications, numerical methods, AC losses.