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The current state of the art in comprehensive computer analysis of quench in pool-cooled superconducting multi-coil magnets at the NHMFL

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The current state of the art in computer simulation of quench in pool-cooled superconducting magnets, particularly in those consisting of many coils/sections, is viewed. The discussion is mostly about up-to-date solenoid closely-packed epoxy-impregnated LTS high-current-density windings, albeit not only about them. The approach to computer modeling of a quench event is considered in comparison with the approaches by others: basic 2D and 3D models of the process of a normal zone propagation employed at present in the Applied Superconductivity area for quench simulation are reviewed and their practicality is discussed. Some examples of detailed and precise computer analysis of quench events in multi-coil superconducting magnets performed at the NHMFL in an effort to optimize the quench protection systems and the magnets'designs themselves are presented. Methods to take appropriately into account the physical processes that govern and/or affect a superconducting magnet quench behavior (e.g., AC loss generation, the stored energy dumping on diode-controlled shunt resistances, etc.) are dealt with in the work, too, with due regard for time-varying distributions (maps) of the magnetic field and, if required, those of the strain over the coils.

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