

THREE-DIMENSIONAL SIMULATION OF ELECTRIC ARCS: FINITE VOLUME MODELLING OF THE ARC SPLITTING

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Electric arcs are used as a quickly acting switching element in current limiting low voltage circuit breaking devices. Aiding the development process by numerical calculations requires proper modelling of the arc root effects, especially when the arc splitting process is focused. In the last few years, simulations of moving electric arcs of several kA often include a current dependent voltage drop at the arc roots. Common finite element methods are not very well suited for local jumps of the field quantities, since this requires duplicated node values at the walls or special transport quantities at the solid elements near the runners' walls. Hence, an electric potential solver based on the finite volume technique is presented to circumvent these problems.

The presented arc simulation features a multi-band P1 radiation model, and is coupled to fluid dynamics, external circuit and magnetic field implementations. To verify the calculation results, a transient and three dimensional simulation of an electric arc in a geometry resembling miniature circuit breaker conditions is compared to experimental results.

These include e.g. the individual mean potentials of the splitter plates, as well as multi-exposure photos, pressure data and overall voltage and current curves.

Keywords: Arc splitting, Simulation, Arc discharges, Low voltage circuit breakers, P1 radiation model.

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