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Modeling of electrical discharges using FEniCS[1] ALEKSANDAR
P. JOVANOVIC, DETLEF LOFFHAGEN, MARKUS M. BECKER, Leibniz Institute for Plasma Science and Technology, Felix-Hausdorff-Str. 2, 17489 Greifswald, Germany — Numerical models represent a common tool for the description and analysis of physical processes in electrical discharges. The commercial software package COMSOL Multiphysics is frequently used as a modeling environment. Here, we present results of a benchmark study comparing COMSOL with FEniCS, an open-source computing platform for solving partial differential equations by the finite-element method, which provides a built-in mesh generator as well as support for parallel processing. The benchmark is based on an axisymmetric model of a positive streamer in air, which was recently used for the comparison of six simulation codes (B. Bagheri *et al.*, *Plasma Sources Sci. Technol.* **27** (2018) 095002). The model consists of Poisson's equation coupled with a drift-diffusion equation for electrons and a reaction equation for ions. In order to verify the newly developed FEniCS code, results are compared to the published benchmark data. To test the performance of the code, calculation times for the benchmark case using different number of cores, both for FEniCS and COMSOL are compared. Good agreement of the results and comparable performance is found.

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