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Numerical Approaches for the Optimization of Plasma Sources for Space Thrusters DAVIDE MELAZZI, CISAS "G. Colombo," University of Padova, Italy, VITO LANCELLOTTI, Eindhoven University of Technology, Eindhoven, The Netherlands, ALESSANDRO CARDINALI, Associazione Euratom-ENEA sulla Fusione, Frascati, Rome, Italy, MARCO MANENTE, hit09 S.r.l., Padova, Italy, DANIELE PAVARIN, University of Padova, Italy — The optimization of radiofrequency magnetized plasma sources for space thrusters has focused on power deposition in nonuniform plasmas. However, many researchers assumed rather than computed the induced current density on the antenna, and considered a uniform and constant magneto-static field aligned with the source axis. To overcome these limitations, we propose two methods: (i) a full-wave approach to compute the current distribution on the antenna and (ii) a ray-tracing approach to investigate the influence of actual magneto-static fields on the wave propagation and power deposition. Plasma density profiles are included in both approaches. In the full-wave method, we derive a surface integral equation for the antenna and a volume integral equation for the plasma by applying the electromagnetic equivalence principles. A comparative study of different antennas will be presented. In the second method, the propagation and absorption of electromagnetic waves are investigated by solving the 3D Maxwell-Vlasov model equations by a WKB asymptotic expansion. Unconventional mode conversions and power deposition profiles are found when realistic confinement magnetic field are considered.

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