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Numerical investigation of stability of current transfer to thermionic cathodes[1] MARIA JOSE FARIA, MIKHAIL BENILOV, Departamento de Fisica, Universidade da Madeira, Largo do Municipio, 9000 Funchal, Portugal — Considerable advances have been achieved in recent years in theory and modelling of current transfer from high-pressure arc plasmas to thermionic cathodes. Solutions describing the diffuse mode and different spot modes have been obtained and analyzed. However, this information is not yet sufficient for engineering practice: one needs to know also which of the modes are stable in some or other particular conditions. Unfortunately, a self-consistent stability theory is absent; hypotheses and speculations available in the literature are insufficient to explain experimental findings. In this work, stability of various modes of current transfer to thermionic cathodes of high-pressure arcs is studied numerically. The model of nonlinear surface heating is used. Particular attention is paid to the case where the arc is powered by a current source. It is found that the diffuse mode is stable at currents exceeding that corresponding to the first bifurcation point and is unstable at lower currents. The first spot mode is unstable between the bifurcation point and the turning point and is stable beyond the turning point. The second and subsequent spot modes are always unstable.

[1]Work performed within activities of the project POCI/FIS/60526/2004

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