A quasi-exponential formula for the current–voltage characteristics of low conductive dielectric fluids in the presence of high-voltage electric field was obtained analytically by solving the system of equations [1]. These equations are for the pre-breakdown charge formation in quasi-neutral media such as transformer oil and they were derived earlier by the first author of this work. The high-voltage electric field is created by the “wire on plane” system of electrodes. A linear dependence of the radius of the micro-breakdown zone in the vicinity of the edge of the needle electrode was obtained from this system of equations.

The MacCormack method was used for numerical analysis of the pre-breakdown characteristics of weakly conductive liquid media. The problem was solved taking into account the influence of the space charge field on the field of high-voltage electrode system “wire on plane”. The results are presented for several values of the applied dc voltage.