Corner layer properties and intermediate asymptotics of waiting time solutions of nonlinear diffusion equations
C. Perazzo, C. Vigo, J. Gratton
International Journal of Heat and Technology 21, 1, 121-128, 2003

Many phenomena such as flows in porous media, viscous-gravity currents, etc. are described by nonlinear diffusion equations of the type $h_t = (h^n h_x)_x$. The solutions can show very interesting properties, like waiting time, a period of time in which the front is at rest while the profile behind it is modified, and corner layers (small regions where the first spatial derivatives varies strongly). Previously we solved numerically the nonlinear diffusion equation for initial conditions with power law behavior and investigated the dependence of the waiting time on the initials conditions and the nonlinearity parameter $m$. Here we analyze in details the formation, evolution and motion of the corner layer, and its dependence on $m$. We show that in $m$ increases, the corner layer forms nearer to the waiting front, and closer to the start-up. Its velocity as it approaches the front tends to coincide with the velocity of front at start-up. We also investigate the intermediate asymptotics close to the front and near start-up. We detect two self-similar regimes: the first one appears in a domain close to the corner layer that is arriving at the front and the other occurs in a domain behind the corner layer but a little farther from it than the first one. The first regime approaches a constant velocity traveling wave, while the second one belongs to a different type of self-similarity.