A general analytical solution of three dimensional time dependent magnetic reconnection in a compressible plasma

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An analytical solution of three dimensional time dependent Petschek type reconnection in compressible plasma [1] is extended to the general case of skewed fields, plasma velocities as well as an X-line of finite length.
In this model it is assumed that all dissipative processes responsible for reconnection are localized in an idealized reconnection line of effective finite length and can be taken into account by specifying a time and space varying reconnection rate. An electric field pulse launches a series of large amplitude non-linear MHD waves which redistribute the initial current and form a structured region with accelerated and heated plasma inside. In this way, magnetic energy is effectively converted into kinetic and internal energy of the plasma.
The time-coordinate representation of the solution is given in form of convolution integrals over the reconnection initializing electric field which allows to compute all related quantities like magnetic fields, pressure, mass density, plasma velocities as well as shape of moving waves. As an example, reconnection of flux tubes in a sheared magnetic field geometry with initial plasma velocities is analyzed.

Reference
1. V.S. Semenov, M.F. Heyn and I.B. Ivanov Phys. Plasmas, 62 (2004).