Wave structures excited in compressible Petschek-type magnetic reconnection

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We present a method to analyze the wave and shock structures arising from Petschek-type magnetic reconnection. Based on a time-dependent analytical approach developed by Heyn and Semenov (1996) and Semenov et al. (2004), we calculate the perturbations caused by a delta function-shaped reconnection magnetic field, which allows to achieve a representation of the plasma variables in the form of Green's functions. Different configurations for the initial conditions are considered. In the case of symmetric, antiparallel magnetic fields and symmetric plasma density, the well-known structure of an Alfvén discontinuity, a fast volume wave, a slow shock, a slow wave, and a tube wave occurs. In the case of asymmetric, antiparallel magnetic fields, additionally surface waves are found. We also discuss the case of symmetric, antiparallel magnetic fields and asymmetric densities, which leads to a faster propagation in the lower half plane, causing side waves forming a Mach cone in the upper half plane. Complex effects like anisotropic propagation characteristics, intrinsic wave coupling, and the generation of different non-linear and linear wave modes in a finite beta plasma are retained. The temporal evolution of these wave and shock structures is shown.