Two-dimensional asymmetric Kan-like exact equilibria

Daniil Korovinskiy (1), Darya Kubyshkina (1), Vladimir Semenov (2), Marina Kubyshkina (2), Nikolai Erkaev (3,4), and Stefan Kiehas (1)

(1) IWF/ÖAW, Graz, Austria (daniil.korovinskiy@gmail.com), (2) Saint Petersburg State University, St. Petersburg, Russia, (3) Institute of Computational Modelling, FRC "Krasnoyarsk Science Center" SBRAS, Krasnoyarsk, Russia, (4) Siberian Federal University, Krasnoyarsk, Russia

The well-known Harris-Fadeev-Kan-Manankova family of exact two-dimensional equilibria is generalized to reproduce asymmetric magnetotail-like current sheets. The new model renders the current sheet bending and shifting in the midday-noon plane, arising from the Earth dipole tilting and the solar wind non-radial propagation. It is found that the original Kan's solution represents an only degenerated case, when normal magnetic component is decreasing in tailward direction as fast as $1/x^3$; the generalized solution allows magnetic configurations with equatorial magnetic field of the order of $1/x$. In addition to Fadeev-Manankova configurations with multiple magnetic islands, configurations with a single X-point are also available. The analytical solution is compared with the T96 empirical model in terms of the magnetic flux tube volume for quiet, substorm and storm magnetospheric conditions. The comparison revealed that free parameters of the analytical model may be adjusted to fit a wide range of realistic current sheets. The best agreement between analytical and empirical models is obtained for the midtail at distances beyond $10 - 15\,R_E$ at high levels of magnetospheric activity.