Exact Axially and Helically Symmetric Magnetohydrodynamic Equilibria
Jason M. Keller and Alexei F. Cheviakov
Department of Mathematics and Statistics, University of Saskatchewan

Applications of Magnetohydrodynamic

The Mathematical Model – Magnetohydrodynamics Equations

Axially Symmetric Plasma

Static Plasma Equations

Axially Symmetric Plasma

Positive Pressure Axially Symmetric Plasma Configurations

Exact Axially Symmetric Plasma Physical solutions: First Family

Exact Axially Symmetric Plasma Physical solutions: Second Family

Conclusions

Summary

Exact solutions of nonlinear physical equations like MHD are highly important; hard to obtain.

In axially and helically symmetric reductions, the model is drastically modified to yield single PDEs (CS, JFKO).

Even Linear cases of GS, JFKO correspond to nonlinear MHD equations. Using linear methods (separation of variables), one can find physically meaningful exact solutions corresponding to static plasma equilibria.

New results:

- Use Galas-Bogoyavlenskij transformations [7] to obtain exact dynamic localized plasma equilibria ($V \neq 0$) from new solutions.

Future Work

- Analyze stability of the new exact solutions.
- Take into account other effects including anisotropy, viscosity and conductivity in non-ideal plasmas.

References
