

Relaxation Properties of Collision Metric Brackets and Plasma Equilibria

C Bressan^{1,2}, M Kraus^{1,2}, P J Morrison³ and O Maj^{1,2}

¹ Max-Planck-Institute for Plasma Physics, Garching, Germany

² Technische Universität München, Zentrum Mathematik, Garching, Germany

³ The University of Texas at Austin, Physics Department and Institute for Fusion Studies, USA

E-mail: camilla.bressan@ipp.mpg.de, michael.kraus@ipp.mpg.de,
morrison@physics.utexas.edu, omaj@ipp.mpg.de

Abstract. In plasma physics, the computation of general 3D magnetohydrodynamics (MHD) equilibria plays a fundamental role for fusion devices such as Tokamaks and Stellarators. Different numerical approaches have been already proposed [1, 2, 3, 4, 5]. This work presents a relaxation method built in the framework of metriplectic dynamics, a concept first proposed by Morrison [6, 7]. It allows us to design artificial dynamical systems which relax to equilibria of the original physical system. This approach improves standard relaxation methods in that the final equilibrium state depends on the entropy functional and a set of boundary conditions only, but not on the initial configuration.

A class of operators which satisfies this property is constructed along the lines of the well-known Landau collision operator, which intrinsically possesses a metriplectic structure [6, 7]. The proposed method is discussed theoretically and the application to relevant physical models is presented.

References

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