

Incompressible Limits at Large Mach Number for a Reduced Compressible MHD System

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Abstract

This paper studies a singular limit problem for a reduced model for compressible non-resistive MHD. This system can also be related to a certain class of two-fluid models. By a suitable rescaling of the magnetic pressure in terms of some parameter $\varepsilon > 0$, by letting $\varepsilon \rightarrow 0$ we perform the incompressible limit while keeping the Mach number of order $O(1)$. The study is conducted in the framework of global in time finite energy weak solutions and for ill-prepared initial data. We also consider a similar problem in presence of a strong Coriolis term. The key ingredient of the proof, based on a compensated compactness argument, is the use of the transport equation (well-known in the context of two-fluid models) underlying the dynamics. Thanks to it, and differently from previous studies about the incompressible limit, we are able to identify the asymptotics of the terms of order $O(\varepsilon)$ and to characterise their dynamics; such an information is in fact crucial to obtain a closed system in the limit. This is recent joint work with Francesco Fanelli and Young-Sam Kwon.

References

- [1] Francesco Fanelli, Young-Sam Kwon, Aneta Wróblewska-Kamińska. Incompressible limits at large Mach number for a reduced compressible MHD system. arXiv:2512.18078