PROJECTIVE INTEGRATION FOR INELASTIC BOLTZMANN EQUATION

ABSTRACT. This paper introduces a new moment system to solve kinetic equations based on machine learning. To this end, a set of generalized moments are firstly constructed through an autoencoder to optimally characterize the velocity distribution. The moment system is then closed with the aim of best capturing the associated dynamics. The reduced system is interpretable like the conventional PDEs and works independently of the numerical discretizations. In the one-dimension BGK model, the algorithm achieves a uniform accuracy in a wide range of regimes spanning from the hydrodynamic limit to free molecular flow. This makes the proposed method a new candidate for solving kinetic equations with a wide variation of mean free path.

TODO
- related literature, asymptotic preserving, time relaxed Monte Carlo
- a schematic plot
- result of classical moment method
- comparison of computational cost with original
- discussion: fully nonlinear or perturbative

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REFERENCES