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Compactness property of the linearized Boltzmann operator

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We consider the Boltzmann equation that models a polyatomic gas by taking into account the continuous microscopic internal energy I. In particular, we consider the kinetic system proposed by [2], which is based on the procedure of Borgnakke and Larsen [1]. We linearize the Boltzmann equation around the Maxwellian function, which represents the equilibrium distribution function. Under some convenient assumptions on the collision cross-section B, we prove that the linearized Boltzmann operator L is a Fredholm operator. For this, we write L as $L = K - \nu.I$, and we prove that K is a compact operator. The compactness is achieved as a result of K being a Hilbert-Schmidt integral operator.

This work was indeed done by Grad [3] for a monoatomic single gas, and by Pavic [4] for a mixture of monoatomic gases.

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