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One-dimensional wave kinetic theory

Kinetic theory aims to write effective equations for the statistical laws arising in microscopic systems with many degrees of freedom. Such equations, referred to as kinetic equations, have been studied dating back to the Boltzmann equation in the late 1800's and were later proposed for wave systems in the mid-1900's. Wave kinetic equations (WKEs) have been rigorously derived in dimension $d \geq 2$, but are less understood both physically and mathematically in dimension one. Here we consider the MMT (Majda, McLaughlin, and Tabak) model, a 1D dispersive model first proposed with the purpose of performing numerical studies on wave turbulence. This model encompasses various dispersive relations, some of which yield a trivial wave kinetic equation. For all dispersion relations we derive the (potentially trivial) WKE, and begin to answer the question of what the appropriate kinetic theory is in the setting when the WKE is trivial.