Nonequilibrium statistical operator in the generalized molecular hydrodynamics of liquids

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The investigations of nonequilibrium processes in classical and quantum systems far from equilibrium, which are characterized by their own lifetime (relaxation time), are actual in modern theory for nonequilibrium processes. Taking into consideration that definite nonequilibrium statistical operator corresponds to the state of molecular hydrodynamics the question for considerations beyond the framework of molecular hydrodynamics arises. Using new interpretation of the Zubarev nonequilibrium statistical operator (NSO) method, in which operation of taking of invariant part in NSO is treated as averaging of quasiequilibrium statistical operator on distribution of past lifetime of system, we construct a nonequilibrium statistical operator and derive the corresponding transport equations for a system that relaxes and passes into the state of molecular hydrodynamics. Deriving the equations an explicit dependence of the NSO on time was taken into account. By the structure of memory functions, transport equations involve second-order terms with respect to time-correlation functions. Together with the nonequilibrium statistical operator, they can describe nonequilibrium processes connected with the relaxation of the state of a system of interacting particles to the state of molecular hydrodynamics. The equations describing the time-correlation functions and corresponding to the system of transport equations are important. According to the structure of memory functions, they must be constructed for the extended set of dynamical variables.