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HELVETICA PHYSICA ACTA
Zusammenfassungen der letzten eingegangenen Arbeiten
Résumés des derniers articles reçus

Stochastic processes I: Asymptotic behaviour and symmetries

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(19.X.1977)

Abstract. Various features of Markov processes describing statistical systems in equilibrium and nonequilibrium are discussed. We study the spectral properties of stochastic operators and the consequences for the asymptotic behaviour of solutions of general master equations. In this context we introduce the concept of ergodic classes in state space and extremal probabilities. Furthermore, we investigate the symmetry properties of stochastic processes. We discuss the consequences for stochastic processes of both: symmetry transformations in state space and symmetry properties obtained by interchanging the time arguments in the joint-probability (generalized detailed balance). Various symmetry relations for multivariate probabilities and multi-time correlation functions are obtained. In addition, a necessary and sufficient operator condition for the generalized detailed balance symmetry is derived.

Stochastic processes II: Response theory and fluctuation theorems

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(19.X.1977)

Abstract. Linear and nonlinear response theory are developed for stationary Markov systems describing systems in equilibrium and nonequilibrium. Generalized fluctuation theorems are derived which relate the response function to a correlation of nonlinear fluctuations of the unperturbed stationary process. The necessary and sufficient stochastic operator condition for the response tensor, $\chi(t)$, of classical nonlinear stochastic processes to be linearly related to the two-time correlations of the fluctuations in the stationary state (fluctuation theorems) is given. Several classes of stochastic processes obeying a fluctuation theorem are presented. For example, the fluctuation theorem in equilibrium is recovered when the system is described in terms of a mesoscopic master equation. We also investigate generalizations of the Onsager relations for non-equilibrium systems and derive sum rules. Further, an exact nonlinear integral equation for the total response is derived. An efficient recursive scheme for the calculation of general correlation functions in terms of continued fraction expansions is given.

Schrödinger invariant generalized heat equations

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Abstract. Invariance under the five-parameter Schrödinger group of coordinate transformations is investigated in the context of the generalized heat equations $u_t - \kappa u_{xx} + F(u, u_x) = 0$. There are four classes of invariant equations, among them Burgers' equation and other nonlinear equations used in fluid dynamics. The Schrödinger invariance is explained by the fact that all invariant equations can be converted from the heat equation by simple transformations of u. A larger number of generalized heat equations is shown to be invariant if a more general concept of Schrödinger invariance is used, and again they are simple conversions of the heat equation. The use of the Schrödinger group in the search for solutions to invariant equations is illustrated by two applications: first the similarity method is generalized to arbitrary one-parameter subgroups and ordinary differential equations are obtained for the invariant solutions, and then, Schrödinger transformations are applied to trivial solutions to produce new, non-trivial solutions.