A KINETIC MODEL OF AGING

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Processes of degradation (“aging”) in closed systems, e.g. organisms, stones, clothes, can be described by the kinetic equations with a certain relaxation time. There is a traditional opinion that for an open system such as living organism description should be different. The ordinary arguments that the biological system is open can be disproved by the fact that all structures (closed and open) are degraded. The difference is that in a case of a closed system a structure (more correct, a structure of the links between elements of the system) is changed with the same molecules. In the open system molecules are changed one to the other. But the structure is reproduced. Thus in the first case molecules of the structure are the same and in the second case molecules are different. We assume that we can consider an “abstract structure” for which one can introduce the “structure distribution function” f_c. We try to write an appropriate kinetic model equation similar to the model relaxation equation. But now the relaxation aging time will appear in the right hand side instead of the ordinary relaxation time related to the “collisions” or chemical reactions, see [1, 2]. Description in terms of the dimensionless time ε (a small ratio of the ordinary relaxation time to the relaxation aging time) allows us to compare results with empirical data [3]. Mathematically the distribution function can be expanded in a small parameter ε or more detail in the “fast” and the “slow” distribution functions. The first describes steady processes in an open system where nonequilibrium structure is a result of transfer and chemical reactions (in the simplest terms “relaxation”). If each of these factors is excluded a system degrades on a scale of the ordinary relaxation time (“a heat death”). The other part (related to “the structural distribution function”) describes slow processes of aging and the kinetic equation for uniform relaxation can be written, i.e. the relaxation in time with the characteristic time of aging can be studied. The proposed consideration is in comparison with experimental facts, in particular it is known from [3] that a value ε is proportional to the number of a heart ticks until death and it is approximately constant for a given class of animals, e.g. mammals. Possibility of establishing the same nonequilibrium state of a system by opening it at scales of the order of the degradation time is also discussed.

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