Session 62 - On stability and control for systems of difference equations: can noise improve the situation?

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Differential and difference equations provide an adequate description of physical and biological phenomena. Significant interest to discrete models is stimulated by complicated types of behavior exhibited even by simple maps. Chaos, though predicted in discrete maps, is not as easily observed in nature as cyclic dynamics, and stochastic perturbations are considered as a reason for this phenomenon. Noise is an integral part of our world, it can be intrinsic, due to internal system processes, as well as extrinsic, due to the influence of the environment. To exclude undesired behavior of discrete maps, control can be introduced, which can also involve a stochastic component. Introduction of noise into discrete modeling, as well as into controls, is quite a natural part of a model design. While sometimes noise destroys stability of a system, we concentrate on the opposite situation, when deterministic control does not stabillize but stochastic one with the same expected value does. For difference equations and systems, we investigate the influence of stochastic perturbations on population survival, chaos control, eventual cyclic behavior, and on local and global stability. We distinguish between the cases when noise can and when it cannot improve stability. The main purpose is to highlight an active role of stochastic perturbations in stabilization of controlled difference models. We consider a competitive Ricker model as an example of a controlled system.

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