Dynamical systems for modeling the evolution of the magnetic field of stars

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The cycles of solar magnetic activity are connected with a solar dynamo that operates in the convective zone. Solar dynamo mechanism is based on the combined action of the differential rotation and the alpha-effect. Application of these concepts allows us to get an oscillating solution as a wave of the toroidal field propagating from middle latitudes to the equator. We investigated the dynamo model with the meridional circulation by the low-mode approach. This approach is based on an assumption that the solar magnetic field can be described by non-linear dynamical systems with a relatively small number of parameters. Such non-linear dynamical systems are based on the equations of dynamo models. With this method dynamical systems have been built for single and double layer media and contains the meridional flow and thickness of the convection zone of the star. It was shown the possibility of coexistence of quiasi-biennial and 22-year cycle and existence of the triple cycle (quasi-biennial, 22- and grand minima). We obtained the different regimes (oscillations, vacillations, dynamo-bursts) depending on the value of the dynamo-number, the meridional circulation, and thickness of the convection zone. We discuss the features of these regimes and compare them with the observed features of evolution of the solar and geo magnetic fields. We built batterfly-diagrams for the helicity, the toroidal and poloidal magnetic field for different regimes.