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Andronov-Hopf Bifurcations in the Quaternions.

The bifurcation of a periodic orbit from an equilibrium point of an autonomous second order differential equation, or Andronov-Hopf bifurcation, is one of the first studied bifurcations of nonlinear systems. This talk addresses the generalization of the canonical Andronov-Hopf model to the noncommutative ring of the quaternions. More specifically, we look for any significant difference in the qualitative dynamical behavior when the underlying space is enlarged to the quaternions. We analyze such systems and show that in fact a broader spectrum of oscillatory behaviors appears, especially if we assume a time dependent family of parameters. When we assume the parameters are autonomous, the behavior of the system follows closely to the behavior in the two dimensional case. In fact, the emerging oscillatory behavior is two dimensional. However, when we assume the parameters are non-autonomous, a large spectrum of different transient oscillations is observed. If we further assume the family of parameters satisfies a commutative condition, we observe a variety of different directions where oscillatory behaviors occur. We represent these different directions by a sputnik-like structure embedded in space. (Received October 04, 2004)