Complicated dynamics in planar nonautonomous planar polynomial ODEs

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We investigate complex dynamics in equations of the form (in complex number notation)

$$\dot{z} = P(\overline{z}, t), \tag{1}$$

where P denotes polynomial in $\overline{z}$ variable and its coefficients are countinuous and T-periodic.

As a one of model equations we consider

$$\dot{z} = Re^{it}\left(\overline{z}^2 - 1\right) + \nu(t, z), \tag{2}$$

where ν is treated as a T-periodic perturbation and $R > 0$ is sufficiently small.

Due to technical reason the main part of the equation (2) has many symmetries. On the other hand nonzero perturbation ν allows one to carry results for this equation to the more general case of (1).

Similarly to [1], existence of distributional chaos is obtained with the analysis of the semiconjugacy of the Poincaré map and shift. In opposite to [2] and [4] the semiconjugacy is not based on the existence of periodic solutions of the ODE but is based on the existence of heteroclinic solutions between the periodic ones. Moreover we investigate the case of small leading coefficient R.

[3, 4, 5] shows that obtaining semiconjugacy to shifts with higher topological entropy than full shift over two symbols is a difficult task. We show how to obtain such a semiconjugacy in our case.

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