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LIMIT CYCLES IN UNIFORM ISOCHRONOUS CENTERS OF DISCONTINUOUS DIFFERENTIAL SYSTEMS WITH FOUR ZONES

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Abstract. We apply the averaging theory of first order for discontinuous differential systems to study the bifurcation of limit cycles from the periodic orbits of the uniform isochronous center of the differential systems $\dot{x} = -y + x^2$, $\dot{y} = x + xy$, and $\dot{x} = -y + x^2y$, $\dot{y} = x + xy^2$, when they are perturbed inside the class of all discontinuous quadratic and cubic polynomials differential systems with four zones separately by the axes of coordinates, respectively.

Using averaging theory of first order the maximum number of limit cycles that we can obtain is twice the maximum number of limit cycles obtained in a previous work for discontinuous quadratic differential systems perturbing the same uniform isochronous quadratic center at origin perturbed with two zones separately by a straight line, and 5 more limit cycles than those achieved in a prior result for discontinuous cubic differential systems with the same uniform isochronous cubic center at the origin perturbed with two zones separately by a straight line. Comparing our results with those obtained perturbing the mentioned centers by the continuous quadratic and cubic differential systems we obtain 8 and 9 more limit cycles respectively.

1. Introduction and statement of the main results.

Suppose that $q \in \mathbb{R}^2$ is a center of a polynomial differential system in $\mathbb{R}^2$. Without loss of generality we can assume that q is at the origin of coordinates. Then q is an *isochronous center* if there exists a neighborhood U_q of q such that all periodic orbits in U_q have the same period. An isochronous center is *uniform* if in polar coordinates $x = r\cos\theta$, $y = r\sin\theta$ it can be written as $\dot{r} = G(\theta, r)$, $\dot{\theta} = k$, $k \in \mathbb{R}\setminus\{0\}$. For further details see

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