A NEW APPROACH TO OBTAINING LIMIT CYCLES

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We consider piecewise quadratic perturbations of centers of piecewise quadratic systems in two zones determined by a straight line through the origin. By means of expansions of the displacement map, we calculate the averaging functions without dealing with the unsurprising difficult integrals inherent in the usual approach. Then we "eliminate" the ϵ and argue by means of certain blow ups in the perturbative parameters in order to obtain a family of limit cycles close to the origin. We apply the technique to non-smooth perturbations of the four families of isochronous centers of the Loud family, S_1, S_2, S_3 and S_4, as well as to non-smooth perturbations of non-smooth centers given by putting different S_i's in each zone. In order to show the coverage of our approach, we apply its first order, which is equivalent to the usual averaging method of order 1, in perturbations of the already mentioned centers considering all the straight lines. Also, we apply its second order to perturbations of the above centers for a specific oblique straight line. As a consequence of our study, we obtain examples of piecewise quadratic systems with at least 12 limit cycles. So that the best lower bound for the number of limit cycles of a piecewise quadratic system is up to now the 12 limit cycles founded in the present paper.

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