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Criticality via first order development of the period constants.

We study the criticality of some planar systems of polynomial differential equations of low degree having a center. We present a method that is equivalent to the use of the first non-identically zero Melnikov function in the problem of limit cycles bifurcation, but adapted to the period function. We will use a first order analysis for families to provide lower bounds for the number of critical periods. We will see in a simple example that it is equivalent of a second order development in some special points for a special center. This mechanism can be used indistinctly in polynomial differential equations or piecewise polynomial differential equations.