

CENTRE AND ISOCHRONICITY CONDITIONS FOR SYSTEMS WITH HOMOGENEOUS NONLINEARITIES ¹

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Abstract. We study the centre-focus problem for systems with homogeneous nonlinearities. Afterwards, in the centre case we study the characterization of the isochronous centres. More explicitly, we derive six necessary conditions to be a centre and six necessary conditions to be an isochronous centre. These conditions are expressed in complex notation and are suitable to be utilized in any computer algebra system. By using this approach we reobtain the necessary and sufficient conditions to be a centre or an isochronous centre for a general system with homogeneous nonlinearities of degree two or three.

1. Introduction and main results

In this paper, we deal with systems of the form

$$(1) \quad \dot{z} = iz + F_n(z, \bar{z}),$$

with $n \in \mathbb{N}$ and $F_n(z, \bar{z})$ a homogeneous polynomial of degree n . Our goal is to give necessary conditions to ensure that the origin of this system is a centre or an isochronous centre.

The change of variables $R^2 = z\bar{z}$, $\theta = \arctan \frac{Imz}{Rez}$, transforms the system (1) into :

$$(2) \quad \begin{cases} \dot{R} = Re(S_n(\theta))R^n, \\ \dot{\theta} = 1 + Im(S_n(\theta))R^{n-1}, \end{cases}$$

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