Existence and uniqueness results for Liénard's equation having a dead band

In the first part of the present paper we consider general systems of first-order autonomous differential equations and generalize a uniqueness criterion by Dulac concerning periodic solutions to equations of the form $\dot{x} = P(x,y)$, $\dot{y} = Q(x,y)$. In the second part we use this result to generalize a uniqueness theorem by de Figueiredo concerning periodic solutions to Liénard's equation $\ddot{x} + f(x)\dot{x} + g(x) = 0$. By our method we are able to avoid the hitherto usual condition $xg(x) > 0$, $x \neq 0$, which excludes the possibility for the equation to have a dead band. Finally, we prove an existence theorem concerning periodic solutions to such equations. The use of the theorems is illustrated by a simple example in the last section.

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