

On non-negative periodic solutions of second-order differential equations with mixed sub-linear and super-linear non-linearities

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We will present efficient conditions for the existence and uniqueness of a non-trivial non-negative ω -periodic solution to the equation

$$u'' = p(t)u + q(t, u),$$

when the function q may contain both sub-linear and super-linear non-linearities. In particular, we will show that for an arbitrary $p \in L([0, \omega])$, the problem

$$u'' = p(t)u + \sqrt[3]{u} - u^3; \quad u(0) = u(\omega), \quad u'(0) = u'(\omega)$$

has at least one non-trivial non-negative solution.