Abstract. A solution $X(t)$ of the fifth order nonlinear differential equation
\[ x^{(v)} + ax^{(iv)} + bx''' + cx'' + dx' + h(x) = p(t, x, x', x'', x''', x^{(iv)}) \] 
with $a, b, c, d$ positive constants, $h$ and $p$ continuous, is said to be a Demidovich limiting regime if $(X^2 + X'^2 + X''^2 + X'''^2 + X^{(iv)}^2) \leq m$ for a finite $m$ and all $t \in \mathbb{R}$, and if every other solution converges to $X$ as $t \to \infty$. In this paper, we give some sufficient conditions in order for all solutions of the equation (*) to converge to a limiting regime under some boundedness restrictions on the incrementary ratio $\frac{h(\zeta + \eta) - h(\zeta)}{\eta}, \eta \neq 0$, and prove that this limiting regime is periodic or almost periodic in $t$ according as $p$ is periodic or almost periodic in $t$, uniformly in $x, x', x'', x''', x^{(iv)}$.

Keywords. Demidovich’s limiting regime, periodic solutions, almost periodic solutions.

AMS (MOS) subject classification: 34C11, 34C25, 34C27.

1 Introduction

In this paper, we shall consider the fifth order nonlinear differential equation
\[ x^{(v)} + ax^{(iv)} + bx''' + cx'' + dx' + h(x) = p(t, x, x', x'', x''', x^{(iv)}), \] 
in which $a, b, c, d$ are positive constants and the functions $h$ and $p$ are assumed continuous. Furthermore the function $h$ is assumed not to be necessary differentiable but only required to satisfy the incrementary ratio
\[ \frac{h(\zeta + \eta) - h(\zeta)}{\eta} \in I_0, \ \eta \neq 0, \] 
where $I_0$ is a certain sub-interval of the Routh-Hurwitz interval. The function
\[ p(t, x, x', x'', x''', x^{(iv)}) \] 
is assumed to have the form
\[ p(t, x, x', x'', x''', x^{(iv)}) = q(t) + r(t, x, x', x'', x''', x^{(iv)}) \]