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On stabilization of functions and free boundary variational problems on unbounded intervals [Summary]

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ON STABILIZATION OF FUNCTIONS AND FREE BOUNDARY VARIATIONAL PROBLEMS ON UNBOUNDED INTERVALS

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We consider the class of functions $u : (1,\infty) \to \mathbb{R}$ which stabilize to polynomials $P(t;u) = \sum_{m=0}^{r-1} a_m t^m$ ($r \in \mathbb{N}$ is fixed) as $t \to +\infty$. For functions from this class the inequality

$$|u^{(s)}(t)| \leqq c\Big(\sum_{\mu=1}^{k} |u^{(i_\mu)}(1)| + \sum_{\nu=1}^{\ell} |a_{j_\nu}| + ||\phi u||_{L_p(1,+\infty)} \Big) ,$$

$$1 \leqq p \leqq +\infty , \quad j = 0,1,\dots,r-1 , \quad t \in (1,+\infty) ,$$

is established where ϕ is a given function (a weight), $t^{\alpha}\phi^{-1} \in L_q(1,+\infty)$, $\alpha > r - 1$, $1/p + 1/q = 1$, $k + \ell \geqq r$; $\{i_\mu\}_{\mu=1}^{\mu=k}$ and $\{j_\nu\}_{\nu=1}^{\nu=\ell}$ are admissible sets of indices $i, j \in \overline{0, r-1}$, connected with the Pólya problem [1], a_{j_ν} are the coefficients of the polynomial $P(t;u)$, the constant $c > 0$ is independent of the function u [2,3] .

In the case $p = 2$ we prove existence and uniqueness of a function minimizing the corresponding quadratic functional in the class considered, $u^{(i_\mu)}(1)$, $\mu = 1,\dots,k$, and a_{j_ν} , $\nu = 1,\dots,\ell$, being fixed.

The conditions are explained which are satisfied by the solution to this problem with arbitrary values of i and j at the ends of the interval $(1,+\infty)$.

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