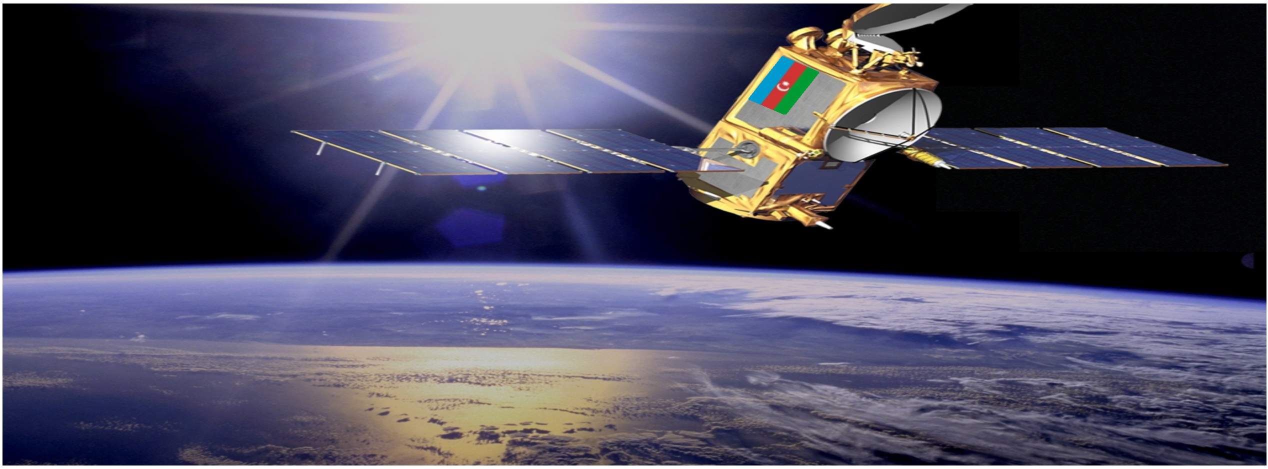

# Riyaziyyat və informatikanın aktual problemləri

## Heydər Əliyevin anadan olmasının 90 illik yubileyinə həsr olunmuş Beynəlxalq konfransın

# TEZİSLƏRİ

# On actual problems of mathematics and informatics

# ABSTRACTS

## of the International conference dedicated to the 90-th anniversary of Haydar Aliyev

# Актуальные проблемы математики и информатики

# ТЕЗИСЫ

## Международной конференции, посвященной 90-летию со дня рождения Гейдара Алиева


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**C O N T E N T S**

**MATHEMATICS**

**ABSOLUTE STABILITY OF ADJUSTABLE SYSTEMS WITH LIMITED RESOURCES IN A SIMPLE CRITICAL CASE**

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A new effective algebraic criterion of absolute stability of the equilibrium position of nonlinear adjustable systems in a simple critical case is developed on the basis of the evaluation of improper integrals along the solution of the system.

Statement of problem: The equation of the motion of a nonlinear system of automatic control in a simple critical case has the form:

$$\dot{x} = Ax + B\varphi(\sigma),\ \dot{\eta} = \varphi(\sigma),\ \sigma = Dx + E\eta, x(0) = x_0,\ \eta(0) = \eta_0,\ t \in I = [0, \infty), \quad (1)$$

where $A, B, D, E$- permanent matrix, the order of the matrix is $n \times n, n \times 1, 1 \times n, 1 \times 1$ appropriately, matrix $A$- Hurwitz matrix, that is to say $Re\lambda_j(A) < 0, j = \overline{1,n}, \lambda_j(A)$- eigenvalues of the matrix $A$.

$$\varphi(\sigma) \in \Phi_0 = \{\varphi(\sigma) \in C(R^1, R^1) \mid \varphi(\sigma) = \varepsilon\sigma + \bar{\varphi}(\sigma),\ 0 \le \bar{\varphi}(\sigma)\sigma \le \mu_0\sigma^2,$$
$$\bar{\varphi}(0) = 0,\ |\bar{\varphi}(\sigma)| \le \bar{\varphi}_*,\ 0 < \bar{\varphi}_* < \infty,\ \forall\sigma,\ \sigma \in R^1\}, \quad (2)$$

where $\varepsilon > 0$ - an arbitrarily small number.

Equilibrium of the system (1), (2) is determined by solving algebraic equations

$$Ax_* + B\varphi(\sigma_*) = 0,\ \varphi(\sigma_*) = 0,\ \sigma_* = Dx_* + E\eta_*.$$

As $A$ - Hurwitz matrix, $\varphi(\sigma_*) = 0$ when $\sigma_* = 0$, so system (1), (2) has unique equilibrium state $(x_* = 0, \eta_* = 0)$ for $E \neq 0$.

The equilibrium state $(x_* = 0, \eta_* = 0)$ of the system (1), (2) is called absolutely stable if the matrix $A$, $A_1(\mu) = \begin{pmatrix} A + B\mu D & B\mu E \\ \mu D & \mu E \end{pmatrix}, 0 < \varepsilon \le \mu < \bar{\mu}_0$, $\mu_0 \le \bar{\mu}_0$ - Hurwitz matrix, and for all $\varphi(\sigma) \in \Phi_0$ solution off differential equation (1) has property $\lim_{t\to\infty} x(t; 0, x_0, \eta_0, \varphi) = x_* = 0$, $\lim_{t\to\infty} \eta(t; 0, x_0, \eta_0, \varphi) = \eta_* = 0$ for any $x_0, \eta_0, |x_0| < \infty, |\eta_0| < \infty$.

Criterion of absolute stability for the system (1), (2) is called the algebraic relations, linking matrix $(A, B, D, E, \mu_0)$ under which the equilibrium state $(x_* = 0, \eta_* = 0)$ is absolutely stable.

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## ON THE BOUNDEDNESS OF PARAMETRIC MARCINKIEWICZ OPERATORS IN GENERALIZED MORREY SPACES

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We study the boundedness of the parametric Marcinkiewicz operators $\mu_\Omega^\rho$ on generalized Morrey spaces $M_{p,\varphi}$. We find the sufficient conditions on the pair $(\varphi_1, \varphi_2)$ which ensures the boundedness of the operators $\mu_\Omega^\rho$ from one generalized Morrey space $M_{p,\varphi_1}$ to another $M_{p,\varphi_2}$, $1 < p < \infty$ and from the space $M_{1,\varphi_1}$ to the weak space $WM_{1,\varphi_2}$.

In 1960, Hörmander considered the $L_p$ boundedness for a class of parametric Marcinkiewicz integral $\mu_\Omega f(x)$, which is defined by

$$\mu_\Omega^\rho(f)(x) = \left( \int_0^\infty \left| \frac{1}{t^\rho} \int_{|x-y|\le t} \frac{\Omega(x-y)}{|x-y|^{n-\rho}} f(y)dy \right|^2 \frac{dt}{t} \right)^{1/2},$$

where $0 < \rho < n$. It is easy to see that when $\rho = 1$, $\mu_\Omega^\rho$ is just $\mu_\Omega$ introduced by Stein in 1958.

Let $1 \le p < \infty$ and $B(x,r)$ denotes the open ball centered at $x$ with radius $r$. We denote by $M_{p,\varphi}(\mathbb{R}^n)$ the generalized Morrey space, the space of all functions $f \in L_p^{\rm loc}(\mathbb{R}^n)$ with finite quasinorm $\|f\|_{M_{p,\varphi,P}} = \sup\limits_{x\in\mathbb{R}^n, r>0} \varphi(x,r)^{-1}\, r^{-\frac{n}{p}}\, \|f\|_{L_p(B(x,r))}$. Also by $WM_{p,\varphi}(\mathbb{R}^n)$ we denote the weak generalized Morrey space of all functions $f \in WL_p^{\rm loc}(\mathbb{R}^n)$ for which $\|f\|_{WM_{p,\varphi}} = \sup\limits_{x\in\mathbb{R}^n, r>0} \varphi(x,r)^{-1}\, r^{-\frac{n}{p}}\, \|f\|_{WL_p(B(x,r))} < \infty$. Here $\varphi(x,r)$ be a positive measurable function on $\mathbb{R}^n \times (0,\infty)$.

We proved the following theorem is valid.

**Theorem.** *Let $0 < \rho < n$, $1 \le p < \infty$ and $(\varphi_1, \varphi_2)$ satisfies the condition*

$$\int_r^\infty \frac{\varphi_1(x,t)}{t} dt \le C\, \varphi_2(x,r),$$

*where $C$ does not depend on $x$ and $r$. Let also $\Omega$ is a homogeneous function of degree zero on $\mathbb{R}^n$, has mean zero on $S^{n-1}$, and $\Omega \in {\rm Lip}_\alpha(S^{n-1})$, $0 < \alpha \le 1$. Then the operator $\mu_\Omega^\rho$ is bounded from $M_{p,\varphi_1}$ to $M_{p,\varphi_2}$ for $p > 1$ and from $M_{1,\varphi_1}$ to $WM_{1,\varphi_2}$.*

Note that, the boundedness of the Marcinkiewicz operator $\mu_\Omega$ on generalized Morrey spaces $M_{p,\varphi}$ was study in [1].

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