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Matematičke i informacione tehnologije

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P R E D G O V O R

ZBORNIKU RADOVA KONFERENCIJE MIT 2013

Međunarodna konferencija MIT 2013 iz oblasti matematičkih, informacionih i telekomunikacionih nauka koja je održana u periodu od 5.09 - 14.09.2013. godine pokazala je da nauka i prava prijateljstva nemaju granice.

Po treći put u Srbiji je održana konferencija MIT, koja je istovremeno i 9 Konferencija za naše suorganizatore iz Rusije.

Kroz usmene, plenarne i sekcione prezentacije, te kroz poster prezentacije, pokazali smo da uspesno pratimo svetske naučne tokove iz matematičkih nauka, primenjene matematike i informatike.

Potvrdili su Srbi, Rusi i Kazahstanci, zajedno sa naucnicima iz 14 zemalja sveta da u nauci ne postoje granice i da je znanje osnov za sve dalje naučne saradnje i ostvarenja, koja imaju za cilj dobrobit čovečanstva.

Programski komitet MIT 2013
Organizacioni komitet MIT 2013

Dr Hranislav Milošević

Beograd, april 2014. godine

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J. Vujakovic[1], M. Rajovic[2]

PERIODIC SOLUTION OF SECOND ORDER DIFFERENTIAL EQUATION

The theory of periodic functions has been developed in connection with problems of differential equations, stability theory, dynamical systems and so on. The applications include not only ordinary differential equations, but also partial differential equations or equations in Banach and Hilbert spaces. In this paper we use Fourier series to find conditions for existence and uniqueness of periodic solutions of inhomogeneous differential equation of the second order on Hilbert space.

Key words and Phrases: *Periodic solution, Fourier series, second-order differential equation*

INTRODUCTION AND PRELIMINARIES

A real function f is said to be periodic if there is some real number $T>0$, called period, such that $f(x)=f(x+nT)$ for each $n\in\mathbb{N}$.

Let X be a general Hilbert space, $C[-l,l],l>0$ is space of part-by-part continuous functions on segment $[-l,l]$ and let $f:C[-l,l]\to X$ be periodic and absolute continuous function. For such functions are defined Fourier coefficients:

$$a_0=\frac{1}{l}\int_{-l}^{l}f(x)\,dx,\ a_n=\frac{1}{l}\int_{-l}^{l}f(x)\cos\frac{n\pi x}{l}dx,\ b_n=\frac{1}{l}\int_{-l}^{l}f(x)\sin\frac{n\pi x}{l}dx, n\in\mathbb{N}. \tag{1}$$

Fourier series of a function $f\in C[-l,l],l>0$ states

$$\frac{a_0}{2}+\sum_{n=1}^{\infty}\left(a_n\cos\frac{n\pi x}{l}+b_n\sin\frac{n\pi x}{l}\right). \tag{2}$$

Substituting values of coefficient (1), partial sum (2) transforms into

$$S_n(x)=\frac{1}{2l}\int_{-l}^{l}f(t)D_n(t-x)\,dt, \tag{3}$$

where $D_n(u)=\dfrac{\sin\left(n+\frac{1}{2}\right)}{2\sin\frac{u}{2}}$ is Dirichlet's kernel. The formulae (3) may also be written as

$$S_n(x)=\frac{1}{l}\int_{-l}^{l}f(x+u)D_n(u)\,du.$$

We now give some basic properties of Fourier coefficients of functions on Hilbert spaces. For more details we refer the reader to [1]-[3].

Lemma 1. Let X be a Hilbert space and let $f(t)$ be a functions on $C([-l,l],X)$. Then Fourier series of each part-by-part function f converges in mean to that function.

Lemma 2. If Fourier coefficients $a_0,a_n,b_n,n\in\mathbb{N}$ of functions $f\in C([-l,l],X)$, are defined by relations (1), than Parsveal equality is applied $\frac{a_0^{\,2}}{2}+\sum_{n=1}^{\infty}\left(a_n^{\,2}+b_n^{\,2}\right)=\frac{1}{l}\int_{-l}^{l}f^2(x)\,dx.$

Lemma 3. If function $f\in C([-l,l],X)$ has all Fourier coefficients equals to zero, then $f\equiv 0$. If func-

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