Primov Tulkin Islamovich
Senior teacher of the Shakhrisabz branch
of the Tashkent Institute of Chemical Technology
Jamolov Shahboz Jamil oglu
Assistant teacher of Shahrisabz branch
of Tashkent Institute of Chemical Technology
Ziyaev Umrzoq Murodovich
Assistant teacher of Shahrisabz branch of
Tashkent Institute of Chemical Technology

TO MAKE FURE ROWS INTO PRACTICE

Annotation: *This article gives information about and deals with Fransua-Marie Charles Fure, Fure conversion ($\mathcal{F}$), Fure coefficients and series, performing examples accordingly, double function and odd function in Fure series.*

Аннотация: *В этой статье рассматриваются Франсуа-Мари Шарль Фюр, преобразование Фуре ($\mathcal{F}$), коэффициенты Фуре и ряды, выполнение примеров соответственно, двойная функция и нечетная функция в рядах Фуре.*

Keywords: *Fure series, Fure conversion, function, Fure coefficients, integralisation.*

Ключевые слова: *ряд Фуре, преобразование Фуре, функция, коэффициенты Фуре, интегрируемость.*

Fransua-Marie Charles Fure (April 7,1772 - October 10,1837) was a French philosopher and later an important socialist thinker and then recognized as a man associated with “utopian socialism”. An influential thinker, some of the social and moral views that Fure considered radical throughout his life became the mainstream in modern society. For example, it is believed that Fure first used the word “feminism” in 1837. He also has a number of great works in the field of mathematics, one of which is called the Fure Series.

Fure conversion ($\mathcal{F}$) is an operation that converts one function of a real variable to another function of a real variable. This new function describes the coefficients ("amplitude") when the initial function is broken down into elementary components and manifests itself in harmonic oscillations of different frequencies (just as a musical chord can be expressed as the sum of the musical sounds that make it up).

Now, we will talk about the Fure coefficient and the rows.

The function $f(x)$ let be a double function given in [-π ,π]. And it [-π ,π] let the interval be integrable. In this case, $f(x)\cos nx$ double function, $f(x)\sin nx$ ($n = 1,2,...$) while the odd function is and they will be integrated in [- π ,π].

$$a_0 = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)dx \ ,$$

$$a_k = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos(kx)dx\,, \qquad (1.24)$$

$$b_k = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin(kx)dx \qquad (k = 1,2,3,....)$$

With the help of the formulas, we will find the Fure coefficients of the function*f(x)*:

$$a_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos(nx)dx = \frac{1}{\pi}\left[\int_{-\pi}^{0} f(x)\cos(nx)dx + \int_{0}^{\pi} f(x)\cos(nx)dx\right] = \qquad (n = 0,1,2,....)\,,$$
$$= \frac{2}{\pi}\int_{0}^{\pi} f(x)\cos(nx)dx$$

$$b_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin(nx)dx = \frac{1}{\pi}\left[\int_{-\pi}^{0} f(x)\sin(nx)dx + \int_{0}^{\pi} f(x)\sin(nx)dx\right] =$$
$$= \frac{1}{\pi}\left[-\int_{0}^{\pi} f(x)\sin(nx)dx + \int_{0}^{\pi} f(x)\sin(nx)dx\right] = 0 \qquad (n = 1,2,3,...).$$

So, Fure coefficients of the pair *f (x)* function

$$a_n = \frac{2}{\pi}\int_{0}^{x} f(x)\cos(nx)dx \qquad (n = 0,1,2,....),$$
$$b_n = 0 \ \ (n = 1,2,3,...) \qquad (1.25)$$

and Fure series

$$f(x) \approx T(f;x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos(nx)$$

will be like that.

Now the function *f (x)* [-π ,π] Let be the odd function given in and it is this [-π ,π] let the interval be integrable. In this case *f* (*x*) cos *nx* odd function, *f* (*x*) sin *nx* (*n* = 1,2,...) and will be a dual function. Using equations (1.24), we find the Fure coefficients of the function f (x):

$$a_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos(nx)dx = \frac{1}{\pi}\left[\int_{-\pi}^{0} f(x)\cos(nx)dx + \int_{0}^{\pi} f(x)\cos(nx)dx\right] =$$
$$= \frac{1}{\pi}\left[-\int_{0}^{\pi} f(x)\cos(nx)dx + \int_{0}^{\pi} f(x)\cos(nx)dx\right] = 0 \qquad (n = 0,1,2,....).$$

$$b_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin(nx)dx = \frac{1}{\pi}\left[\int_{-\pi}^{0} f(x)\sin(nx)dx + \int_{0}^{\pi} f(x)\sin(nx)dx\right] =$$
$$= \frac{2}{\pi}\int_{0}^{\pi} f(x)\sin(nx)dx \qquad (n = 1,2,3,...).$$

Futhermore, the Fure coefficients of the odd f (x) function

$$a_n = 0 \quad (n = 0,1,2,....),$$
$$b_n = \frac{2}{\pi}\int_{0}^{\pi} f(x)\sin(nx)dx \qquad (n = 1,2,3,...) \qquad (1.26)$$

and Fure series

$$f(x) \approx T(f;x) = \sum_{n=1}^{\infty} b_n \sin(nx)$$

will be like that.

We perform examples using these formulas.

Мисол.

1. $f(x) = x^2$ ($-\pi \le x \le \pi$) Let us find the Fure series of the function. Using formula (1.25) we find the Fure coefficients of the given function:

$$a_0 = \frac{2}{\pi}\int_0^{\pi} x^2 dx = \frac{2}{3}\pi^2 \quad ,$$

$$a_n = \frac{2}{\pi}\int_0^{\pi} x^2 \cos nx dx = \frac{2}{\pi}x^2 \frac{\sin nx}{n}\Big|_0^{\pi} - \frac{4}{n\pi}\int_0^{\pi} x \sin nx dx = \\ = -\frac{4}{n\pi}\left[\left(-x\frac{\cos nx}{n}\right)_0^{\pi} + \int_0^{\pi}\cos nx dx\right] = (-1)^n \frac{4}{n^2} \qquad (n = 1,2,3,\ldots).$$

So, $f(x) = x^2$ this is the Fure array of the function

$$x \approx \frac{\pi^2}{3} + \sum_{n=1}^{\infty}(-1)^n \frac{4}{n^2}\cos nx = \frac{\pi^2}{3} - 4\left(\cos x - \frac{\cos 2x}{2^2} + \frac{\cos 3x}{3^2} - \ldots\right)$$

will be in this shape.

2. This

$$f(x) = x \;\; (-\pi \le x \le \pi)$$

find the Fure series of the odd function.

Using the formulas (1.26) we find the Fure coefficients of the given function:

$$b_n = \frac{\pi}{2}\int_0^{\pi} x \sin nx dx = -\frac{2}{n\pi}x\cos nx\Big|_0^{\pi} + \frac{2}{n\pi}\int_0^{\pi}\cos nx dx = \\ = -\frac{2}{n}\cos n\pi = (-1)^{n+1}\frac{2}{n} \qquad (n = 1,2,3,\ldots).$$

After that, the Fure series of the function f (x) = x will be like that:

$$x \approx \sum_{n=1}^{\infty}(-1)^{n+1}\cdot\frac{2}{n}\sin nx = 2\left(\sin x - \frac{\sin 2x}{2} + \frac{\sin 3x}{3} - \ldots\right).$$

[$-l,l$] Fure line of the given function in the interval.

Here we can see another example.

3. This

$$f(x) = e^x(-1 \le x \le 1)$$

find the Fure series of the function.

Using the formulas (1.29) we find the Fure coefficients of the given function (where l = 1);

$$a_0 = \int_{-1}^{1} e^x dx = e - e^{-1} ,$$

$$a_n = \int_{-1}^{1} e^x \cos n\pi x dx = \frac{n\pi \sin n\pi x + \cos n\pi x}{1+n^2\pi^2} e^x \Big|_{-1}^{+1} = \qquad (n = 1,2,3,\dots),$$
$$= \frac{1}{1+n^2\pi^2}\left(e\cos n\pi - e^{-1}\cos n\pi\right) = (-1)^n \frac{e-e^{-1}}{1+n^2\pi^2}$$

$$b_n = \int_{-1}^{1} e^x \sin n\pi x dx = \frac{\sin n\pi x - n\pi \cos n\pi x}{1+n^2\pi^2} e^x \Big|_{-1}^{+1} == \frac{1}{1+n^2\pi^2}\left(e\cdot n\pi\cos n\pi + e^{-1} n\pi \cos n\pi\right) =$$
$$= \frac{n\pi\cos n\pi}{1+n^2\pi^2}\left(e^{-1} - e\right) = \frac{n\pi(-1)^n}{1+n^2\pi^2}\left(e^{-1}-e\right) = (-1)^{n+1}\frac{e-e^{-1}}{1+n^2\pi^2} n\pi$$
$$(n = 1,2,3,\dots).$$

So, the function $f(x) = e^x$ ($-1 \le x \le 1$) will be like that

$$e^x \approx \frac{e-e^{-1}}{2} + (e-e^{-1})\sum_{n=1}^{\infty}\left[\frac{(-1)^n}{1+n^2\pi^2}\cos n\pi x + \frac{(-1)^{n+1}}{1+n^2\pi^2}\pi n \cdot \sin n\pi x\right]$$

In conclusion, Fure series can be applied not only to examples but also to life processes. That is, signals are analyzed using and with the help of Fure pumps.

In this case, any signal X (t) can be divided into a set of simple sinusoidal functions called Fure series in the time interval from 0 to T (where T is the Fure analysis period or analysis period is the time interval in which the signal is written). In this case, the larger the epoch, the greater the number of harmonics (signal elemental components) and the frequency accuracy for the spectra.

LIST OF USED REFERENCES:

1. 1. Azlarov T., Mansurov Kh. Mathematical analysis, part 1, Tashkent. The Teacher, 1994.
2. https://n.ziyouz.com

3. http://ru.knowledgr.com