Orginal hisob va uning bazi tadbiqlari

Laplas almashtirishlari va hossalari:

Agar haqiqiy o'zgaruvchi f(t) funksita uchun quyidagi shartlar bajarilsa:

1. t<0 da f(t)=0
2. shunday M>0 va S>0 o'zgarmas sonlar mavjud bo'lsaki va $|f(t)| < M \cdot e^{S \cdot t}$ bo'lsa
3. f(t) bo'lakli-uzluksiz yani chekli intervalda chekli sondagi birinchi tur uzilish nuqtalariga ega bo'lsa, u vaqtda quyidagi hosmas integralga Laplas almashtirishlari deyiladi va bunday yoziladi:

$$F(P) \div \int_0^{\infty} e^{-p \cdot t} f(t)\, dt$$

F(P) funksiya f(t) funksiyaning laplas tasviri deb ataladi. f(t) funksiya esa orginal deb aytiladi

Asosiy hossalari:

1. Tasvirning chiziqlilik hossasi:
Ixtiyoriy c_k k=1,2,3..n o'zgarmas sonlar uchun quyidagi tenglik o'rinli:

$$\sum_{k=1}^{n} C_k f(t)_k \div \sum_{k=1}^{n} C_k F_k(P)$$

2. Orginal argumentni musbat songa ko'paytirish xossasi. O'xshashlik teoremasi:
Har qanday o'zgarmas musbat a>0 son uchun quyidagi tenglik o'rinli

$$f(at) \div \left(\frac{1}{a} F\left(\frac{P}{a}\right)\right)$$

3. Orginal argumentni musbat τ>0 vaqtga kechikish xossasi. Kechikish teoremasi:
Agar orginal f(t- τ) ga kechiksa tasvir $e^{-p \cdot \tau}$ ga ko'paytiriladi:

$$f(t-\tau) \div \left(e^{-p \cdot \tau} F(P)\right)$$

4. Tasvirning kechikish hossasi. Siljish teoremasi: Agar orginal $e^{\alpha t}$ ga ko'paytirilsa α ga kechikadi:

$$\left(e^{\alpha t} f(t)\right) \div F(P-\alpha)$$

5. Orginalni difrensiallash hossasi. Agar f(t) va uning hosilalari $f^{(k)}(t)$ orginal k=1,2,3..n bo'lsa

$$f^{(k)}(t) \div P^k F(P) - P^{k-1} f(0) - P^{k-2} f'(0) \cdot -.... - f^{(k-1)}(0)$$

bo'ladi. Husus,an:

$$f'(t) \div P \cdot F(P) - f(0)$$

6. Orginalni integrallash hossasi

$$\int_0^t f(\tau)\, d\tau \div \frac{1}{p} F(P)$$

7. Tasvirni diffrensiallash hossasi. Tasvirni argument P bo'yicha diffrensiallasak orginal -t ga ko'paytiriladi.

$$F^{(n)}(P) \div (-1)^n t^n f(t)$$

8. Tasvirni integrallash hossasi.

$$\int_p^{\infty} F(p)\, dp \div \frac{1}{t} f(t)$$

9. Tasvirlarni ko'paytirish hossasi. Borel teoremasi.

Agar $f(t) \div F(P)$ va $g(t) \div G(P)$ bo'lsa $F(P) \cdot G(P) \div f \times g \div \int_0^t f(\tau)\, g(t-\tau)\, d\tau$

$f \times g$ simvol f(t) va g(t) funksiyalarni kompozitsiyasi (o'ramasi) deb ataladi.

10. Dramel integrali. Agar $f(t) \div F(P)$ va $g(t) \div G(P)$ bo'lsa

$$P \cdot F(P) \cdot G(P) \div f(0)\, g(t) + (f' \times g)(t)$$

bo'ladi. Bu yerda

$$(f' \times g)(t) = \int_0^t \frac{d}{dt} f(t-\tau)\, g(\tau)\, d\tau$$

Edit by Homidjonov Shavkat.

F(P)	f(t)	F(P)	f(t)
		$\frac{1}{p}$	1
$\frac{p}{p^2+\omega^2}$	$\cos \omega t$	$\frac{1}{e+\alpha}$	$e^{-\alpha t}$
$\frac{p}{p^2-\omega^2}$	$\text{ch}\, \omega t$	$\frac{1}{p - \ln a}$	a^t
$\frac{1}{p(p+\alpha)^2}$	$\frac{1-(1+\alpha t)e^{-\alpha t}}{\alpha^2}$	$\frac{1}{p^2}$	t
$\frac{1}{p^2(p+\alpha)}$	$\frac{e^{-\alpha t}+\alpha t-1}{\alpha^2}$	$\frac{n!}{p^{n+1}}$	t^n
$\frac{1}{p(p^2+\omega^2)}$	$\frac{1}{\omega^2}(1-\cos \omega t)$	$\frac{1}{(p+\alpha)^{n+1}}$	$\frac{t^n}{n!} e^{-\alpha t}$
$\frac{2}{p(p^2+4)}$	$\sin(t)^2$	$\frac{\omega}{p^2+\omega^2}$	$\sin \omega t$
$\frac{p^2+2}{p(p^2+4)}$	$\cos(t)^2$	$\frac{\omega}{p^2-\omega^2}$	$\text{sh}\, \omega t$
$\frac{1}{p^2(p^2+\omega^2)}$	$\frac{1}{\omega^3}(\omega t - \sin \omega t)$	$\frac{1}{(p+\alpha)(p+\beta)}$	$\frac{\left(e^{-\alpha t} - e^{-\beta t}\right)}{\beta - \alpha}$
$\frac{1}{p^n}$	$\frac{t^{n-1}}{(n-1)!}$	$\frac{p+k}{(p+\alpha)^2}$	$[(k-\alpha)t+1]e^{-\alpha t}$
$\text{arctg} \cdot \frac{\omega}{p}$	$\frac{1}{t} \sin \omega t$	$\frac{\omega}{(p+\alpha)^2+\omega^2}$	$e^{-\alpha t} \sin \omega t$
$\ln\left(\frac{p-\alpha}{p-\beta}\right)$	$\frac{1}{t}\left(e^{\beta t} - e^{\alpha t}\right)$	$\frac{p+\alpha}{(p+\alpha)^2+\omega^2}$	$e^{-\alpha t} \cos \omega t$
$\ln\left(\frac{p^2+\alpha^2}{p^2}\right)$	$\frac{2}{t}(1-\cos \alpha t)$	$\frac{1}{p(p+\alpha)(p+\beta)}$	$\frac{1}{\alpha\beta} - \frac{\beta e^{-\alpha t} - \alpha e^{-\beta t}}{\alpha\beta(\beta-\alpha)}$
$\frac{p}{(p^2+\omega^2)^2}$	$\frac{t}{2\omega} \sin \omega t$	$\frac{p+k}{(p+\alpha)(p+\beta)}$	$\frac{(k-\alpha)e^{-\alpha t} - (k-\beta)e^{-\beta t}}{\beta - \alpha}$
		$\frac{p+k}{p^2+\omega^2}$	$\frac{1}{\omega} \cdot \sqrt{k^2+\omega^2} \cdot \sin(\omega t + \phi)$ t