Tranformasi Laplace

Fungsi F (t) dengan domain himpunan bilangan real positif sehingga nilai $\int_0^{\sim} e^{-st} f\ (t)$ dt, dapat di tentukan dimana S suatu parameter tranformasi laplace fungsi (t) ditulis L $\{f(t)\}$.

di definikan sebagai :

L $\{f\ (t)\}$= F $(s) = \int_0^{\sim} e^{-st} f\ (t)$ dt

Beberapa dalil/rumus :

1) L {k} = $\frac{K}{S}$ (S<0)

L {k} = $\int_0^{\sim} e^{-st}$ k dt

= K $\int_0^{\sim} e^{-st}$ dt

= - $\frac{K}{S}$ $(e^{-st} = \frac{K}{S}$

2) L$\{t^n\} = \frac{\mathrm{T(n+1)}}{\mathrm{Sn+1}}$

3) L $\{cost\ k\ t\} = \frac{\mathrm{S}}{S^2+k^2}$

4) L $\{sin\ k\ t\} = \frac{\mathrm{k}}{S^2+k^2}$

5) L $\{e^{at}\} = \frac{1}{\mathrm{S-a}}$

6) L $\{are\ cos\ at\} \frac{\mathrm{a}}{S^2-a^2}$

7) L $\{are\ sin\ at\} = \frac{\mathrm{S}}{S^2-\mathrm{a}}$

8) L $\{f\ (t)\}$ = F (s)

L $\{f\ (t)\}$ = S F $(s) -$ F (0)

9) L $\{f^{(n)}\ t\} = S^n$. F $(s) - S^{n-1}$ F(0) - S^{n-2}F(1)

10) L . { $e^{a.t} f\ (t)\} =$ F $(S - a)$

11) L . { $e^{a,t}. \ t^n\} = \frac{T(n+1)}{(S-a)^{n+1}}$

12) L . { $e^{at}. \ sin\ k\ t\} = \frac{k}{(S-a)^2+k^2}$

13) L { $e^{at}. \ cos\ k\ t\} = \frac{S-a}{(S-a)^2+k^2}$

14) $L\{ \ t^n. \ F(t)\} = (-1)^{(n)} f^{(n)}$

Contoh :

1) $Tentukan\ L\ \{4t^2 - 3cos2t + 5e^{-t}\}$

Jawab :

$L\ \{4t^2 - 3cos2t + 5e^{-t}\}$ = 4L $\{t^2\}$ - 3L $\{cos2\ t\}$ +5L $\{e^{-t}\}$

$= 4\ \frac{2+1}{2^2+1} - 3\ \frac{S}{S^2+2^2} + 5\ \frac{1}{S-(-1)}$

$= \frac{12}{S^3} - \frac{3S}{S^2+4}\ \frac{5}{S+1}$

2) $Tentukan\ \{\ e^{4t}\ cos\ 5t\ \}$

Jawab :

L $\{\ e^{4t}\ cos\ st\ \} = \frac{S-a}{(S-a)^2+t^2}$

$= \frac{S-4}{(S-4)^2+5^2}$

$= \frac{S-4}{(S^2-8s+16)+25}$

$= \frac{S-4}{(S^2-8s+41}$

3) $Tentukan\ e^{2t}\ \{\ 3sin\ 4t - 4cos\ 4t\}$

Jawab :

L $\{e^{at}\}\ \{3l\ \{sin\ 4\ t\}\ 4\ \{cos\ 4\ t\}\ \} = \frac{1}{S-2}\left\{3.\ \frac{4}{S^2+4^2} - 4\ \frac{S}{S^2+4^2}\right\}$