SHIFT THEOREM FOR THE PROBLEM OF FINDING THE ORIGINAL FUNCTION IN MATRIX ARGUMENT FUNCTIONS.

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Abstract. In this article, we summarize the shift theorem for matrix argument functions. Search for a specific image of the original in the operational account concentration image from theorems called shift theorems for table is used. In particular, the shift theorem is generalized for matrix argument functions.

Keywords. Complex symmetric matrix, matrix original function, matrix image function, ordinary power series of matrix argument, Laplace transform.

Definition 1. Let $f(A)$ be a function of $A>0\left(A\in \mathbb{R}\left[m\times m\right]\right)$ and $Z=X+iY$, be a $\left(Z\in \mathbb{C}\left[m\times m\right]\right)$ complex symmetric matrix. The Laplace transform $F(Z)$ of $f(A)$ defined as

$$F(Z)=\int_{A>0}\exp(-ZA)f(A)dA. \qquad (1)$$

Where the integral is assumed to be absolutely convergent in the right half plane $\mathrm{Re}(Z)=X>X_0>0$. Determined by formula (1) the function $f(A)$ is the matrix image function of the matrix original function $f(A)$.The original and image are defined as: $f(A)\xleftarrow{\bullet}F(Z)$ or $F(Z)\xrightarrow{\bullet}f(A)$. (The " $\xleftarrow{\bullet}$ " sign is always oriented to the original.)

The Laplace transform $F(Z)$ of $f(A)$ defined above is an analytic function of Z in the right half plane $\mathrm{Re}(Z)=X>X_0>0$. In addition, if

$$\int_{-\infty<Y=Y'<\infty}\left|F(X+iY)\right|dY<\infty \qquad (2)$$

for all $X>X_0>0$, and

$$\lim_{X\to 0}\left|F(X+iY)\right|dY=0$$

then the unique inverse Laplace transform $f(A)$ of $F(Z)$ is

$$f(A)=\frac{2^{2^{\frac{1}{2}m(m-1)}}}{(2\pi i)^{\frac{1}{2}m(m+1)}}\int_{\mathrm{Re}(Z)=X>X_0>0}\exp(ZA)F(Z)dZ \qquad (3)$$

The function $f(A)$ defined by formula (3) is a matrix original function of the matrix $F(Z)$ image function.

Theorem 1 *(The shift theorem).* If $f(A) \overset{\bullet}{\longleftarrow} F(Z)$, then the following relation

$$e^{\Lambda A} f(A) \overset{\bullet}{\longleftarrow} F(Z-\Lambda) \quad (4)$$

is appropriate for an arbitrary $\Lambda \in \mathbb{C}[m \times m]$.

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