3. The Meanres for Downsampling and Upsampling

Chapter 3

Downsampling and Upsampling
The matrix \( \mathbf{g} \) is the transpose of the matrix \( \mathbf{g}^T \) if we replace \( a \) by \( b \) and \( b \) by \( a \).

\[
\begin{bmatrix}
1 & 1 \\
0 & 0 \\
0 & -1
\end{bmatrix}
\]

\[
\begin{bmatrix}
1 & 0 \\
0 & 0 \\
0 & 1
\end{bmatrix}
\]

\[
\begin{bmatrix}
0 & 1 \\
1 & 0 \\
0 & 0
\end{bmatrix}
\]

The equation \( x' = \mathbf{g}x \) is obtained by the action of \( \mathbf{g} \) on \( x \).

\[
(1, a) \cdot x = (1, a) \cdot 0 = 0
\]

The result of \( (1, a) \cdot x \) is always \( 0 \) for any vector \( x \) in the plane.

\[
(0, b) \cdot x = (0, b) \cdot 0 = 0
\]

\[
(1, b) \cdot x = (1, b) \cdot 0 = 0
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(0, -b) \cdot x = (0, -b) \cdot 0 = 0
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\[
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1 & 0
\end{bmatrix}
\]
\[
\begin{align*}
&[x + (\frac{d}{dx}) x + (\frac{d}{dx}) x] = (m)A \\
&\text{Function definition of } x + (\frac{d}{dx}) x + (\frac{d}{dx}) x \\
&\text{The derivative of } x + (\frac{d}{dx}) x + (\frac{d}{dx}) x \\
&\text{Substitution in the Frequency Domain}
\end{align*}
\]
A. The second equation of the second line of the given text, which states that the coefficient of \(X^n\) in the expansion of \((x+a)^n\) is \(\binom{n}{r}a^{n-r}\), is correct.

B. The given text contains a typographical error in the statement that the coefficient of \(X^n\) in the expansion of \((x+a)^n\) is \(\binom{n}{r}a^{n-r}\). The correct formula is \(\binom{n}{r}a^{n-r}\), not \(\binom{n}{r}a^{n}\).
Chapter 4

Filter Banks