**Group Delay**

**Initial Value Theorem**

If for , .

**Initial/Final Value Theorem**

**Parseval’s Relation (Aperiodic Sig.)**

**Properties of Fourier Transform傅里叶变换的性质**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **Aperiodic signal** | | **Fourier transform** | |
|  |  | |  | |
|  |  | |  | |
| Linearity |  | |  | |
| Time Shifting |  | |  | |
| Frequency Shifting |  | |  | |
| Conjugation |  | |  | |
| Time Reversal |  | |  | |
| Time and Frequency Scaling |  | |  | |
| Convolution |  | |  | |
| Multiplication |  |  | | |
| Differentiation in Time |  | |  | |
| Integration |  | |  | |
| Differentiation in Frequency |  | |  | |
| Conjugate Symmetry for Real Signals | real |  | | |
| Symmetry for Real and Even Signals | real and even | | real and even | |
| Symmetry for Real and Odd Signals | real and odd | | purely imaginary and odd | |
| Even-Odd Decomposition for Real Signals | real | | |  |

**Basic Fourier Transform Pairs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Signal** | | **Fourier transform** | **Fourier series coefficients (if periodic)** |
|  | |  |  |
|  | |  |  |
|  |  | |  |
|  |  | |  |
|  | |  |  |
| Periodic square wave    And | |  |  |
|  | |  |  |
|  | |  |  |
|  | |  |  |
|  | | 1 |  |
|  | |  |  |
|  | |  |  |
|  | |  |  |
|  | |  |  |
|  | |  |  |

**Properties of Laplace Transform拉普拉斯变换的性质**

|  |  |  |  |
| --- | --- | --- | --- |
| **Property** | **Signal** | **Laplace Transform** | **ROC** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Linearity |  |  | At least |
| Time shifting |  |  |  |
| Shifting in the-domain |  |  | Shifted version of |
| Time scaling |  |  | Scaled ROC |
| Conjugation |  |  |  |
| Convolution |  |  | At least |
| Differentiation in the Time Domain |  |  | At least |
| Differentiation in the-domain |  |  |  |
| Integration in the Time Domain |  |  | At least |

**Laplace Transform Pairs**

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Signal** | **Transform** | **ROC** |
| 1 |  |  | All |
| 2 |  |  |  |
| 3 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  | All |
| 11 |  |  |  |
| 12 |  |  |  |

**Z-Transform Pairs**

|  |  |  |
| --- | --- | --- |
| **Signal** | **Transform** | **ROC** |
|  |  | All |
|  |  |  |
|  |  |  |
|  |  | All , except 0 or |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Properties of Z-Transform**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **Signal** | **-Transform** | | **ROC** |
|  |  |  | |  |
|  |  |  | |  |
|  |  |  | |  |
| Linearity |  |  | | At least |
| Tiime shifting |  |  | | except for possible origin |
| Scaling in the -domain |  |  | |  |
|  |  |  | |  |
|  |  |  | | Scaled version of |
| Time reversal |  |  | | Inverted |
| Time expansion |  | |  |  |
| Conjugation |  |  | |  |
| Convolution |  |  | | At least |
| First difference |  |  | | At least |
| Accumuation |  |  | | At least |
| Differentiation in the -domain |  |  | |  |