

**System Properties (Z-Transform)**

|  |  |
| --- | --- |
| Causality | ROC is the exterior of a circle including infinity |
| Causality  (Rational ) | ROC is the exterior of a circle outside the outermost pole + 分子z阶数不能比分母大 |
| Stability | ROC includes the unit circle |

Causal LTI system with rational: all poles lies inside the unit circle + 分子z阶数不能比分母大

**Nyquist Sampling Theorem**

Let be a band-limited signal within , then is uniquely determined by its samples if , where .

Nyquist rate:

**诱导公式**

**Time-Domain Sampling时域采样**

采样后信号的频率响应幅值变为倍，因此恢复信号时要通过一个增益为的BPF，BPF的截止频率最好为；轴上的对应轴上的

连续离散公式：时域，频域，任何地方

时域采样导致频域周期化：

**DFT Geometric Symmetry**

Geometric symmetry: (type1 odd, type2 even)

Geometric anti-symmetry: (type3 odd, type4 even), 中心系数为0

**DFT Matrix Relation**

**信号的分解**

|  |  |  |
| --- | --- | --- |
| 奇偶分解 |  |  |
| 实虚分解 |  |  |
| 共轭对称分解 |  |  |

**Geometric Series等比数列**

通项公式：

两项关系：

求和公式：

**带通采样**

恢复使用gain为的的BPF

|  |  |  |
| --- | --- | --- |
| **系统性质的判据** | 输入输出关系 | 单位冲激响应 |
| Memoryless | Output at depends only on the value of input at | for |
| Invertible | There exist an inverse system |  |
| Causality | Output at this time only depends on values of the input at the present time and in the past | for |
| Stability | BIBO |  |
| Time-invariance | Let  Check | Must satisfy |
| Linearity | Let  Check | Must satisfy |

**圆周卷积算线性卷积**

1. 补0法：两序列都补到长，算圆周卷积即可
2. Overlap-add: 将切段，每段与用补0法算圆周卷积，最后相加时要有长度的overlap
3. Overlap-save: 相加时不重叠，而是切断时重叠长度；最前面补个0，相加时每段舍去前

**Z-变换对快速检查单**

|  |  |  |  |
| --- | --- | --- | --- |
| **Signal** | **Transform** | **ROC** | **Pole** |
|  |  |  |  |
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|  |  |  |  |
|  |  |  |  |

**Fourier-Domain Sampling频域采样**

频域采个样（不关心周期是不是），时域信号就以为周期

多画几个周期找规律！

**Circular Time-Shift/Reversal**

原：0 1 2 3 4

移：3 4 0 1 2

反：0 4 3 2 1

**Group Delay, Phase Delay**

Phase delay:

Group delay:

**离散三角信号的周期性**

**Sinc Function**

**2-Point DFT using a single -Point DFT**

长,

则

**Hilbert Transform**

**Convolution卷积**

一个函数的换成，另一个函数的换成；如果结果以原点为界，记得写成的形式；的图像正常，的图像关于轴翻转后，原点为

**和差化积公式与积化和差公式**

**Z变换特殊峰的判断**

信号为正，零点有峰

信号为负，无穷有峰

**Euler’s formula欧拉公式**

**信号的范数、能量、功率**

Total energy: (Energy signal: finite energy)

Average power: (Power signal: finite power)

Passive system: , lossless system:

**离散三角信号的周期性小结论**

1. 周期必须是整数
2. 角频率相差的信号完全相同
3. 任何数列的最大频率为（folding frequency），且对称频率（和）信号相同