NDK_DFT

Last Modified on 07/07/2016 12:11 pm CDT

- C/C++
- .Net

```
int __stdcall NDK_DFT(double * X,
                      size_t   N,
                      double * retAmp,
                      double * retPhase,
                      size_t   M
                     )
```

Calculates the discrete fast Fourier transformation for amplitude and phase.

Returns

status code of the operation

Return values

NDK_SUCCESS Operation successful
NDK_FAILED Operation unsuccessful. See **Macros** for full list.

Parameters

[in] **X** is the univariate time series data (a one dimensional array).
[in] **N** is the number of observations in X.
[out] **retAmp** is an array of the amplitudes of the fourier transformation components
[out] **retPhase** is an array of the phase angle (radian) of the Fourier transformation components .
[in] **M** is the number of spectrum components (i.e. size of amp and phase)

Remarks

1. The input time series may include missing values (e.g. NaN) at either end, but they will not be included in the calculations.
2. The input time series must be homogeneous or equally spaced.
3. The first value in the input time series must correspond to the earliest observation.
4. The frequency component order, k, must be a positive number less than N, or the error (#VALUE!) is returned.
5. The DFT returns the phase angle in radians, i.e. $0 \lt \phi \lt 2 \times \pi$.
6. The discrete **Excel Fourier** transformation (DFT) is defined as follows: $$ X_k = \sum_{j=0}^{N-1} x_j e^{-\frac{2\pi i}{N} j k} $$ Where:
   - k is the frequency component
   - $x_0,...,x_{N-1}$ are the values of the input time series
   - N is the number of non-missing values in the input time series

7. The Cooley-Tukey radix-2 decimation-in-time fast Excek Fourier transform (FFT) algorithm divides a DFT of size N into two overlapping DFTs of size $\frac{N}{2}$ at each of its stages using the following formula: $$ X_{k} = \begin{cases} E_k + \alpha \cdot O_k & \text{ if } k \lt \dfrac{N}{2} \\ E_{\left (k-\frac{N}{2} \right)} - \ \alpha \cdot O_{\left (k-\frac{N}{2} \right)} & \text{ if } k \geq \dfrac{N}{2} \end{cases} $$ Where:
   - E_k is the DFT of the even-indicied values of the input time series, $x_{2m} \left(x_0, x_2, \ldots, x_{N-2}\right)$
   - O_k is the DFT of the odd-indicied values of the input time series, $x_{2m+1} \left(x_1, x_3, \ldots, x_{N-2}\right)$
   - $\alpha = e^{ \left (-2 \pi i k /N \right)}$,
   - N is the number of non-missing values in the time series data.
8. The unit frequency of the DFT is $\frac{2\pi}{N}$, where N is the number of non-missing observations.

Requirements

Header	SFSDK.H
Library	SFSDK.LIB
DLL	SFSDK.DLL

Examples

```
int NDK_DFT(double[]    pData,
            UIntPtr     nSize,
            short       component,
            short       argRetType,
            out double  retVal
           )
```

Namespace: NumXLAPI
Class: SFSDK
Scope: Public
Lifetime: Static

Calculates the discrete fast Fourier transformation for amplitude and phase.

Returns

status code of the operation

Return values

NDK_SUCCESS Operation successful
NDK_FAILED Operation unsuccessful. See Macros for full list.

Parameters

[in] **pData** is the univariate time series data (a one dimensional array).
[in] **nSize** is the number of observations in pData.
[out] **component** is an array of the amplitudes of the fourier transformation components
[out] **argRetType** is an array of the phase angle (radian) of the Fourier transformation components .
[in] **retVal** is the number of spectrum components (i.e. size of amp and phase)

Remarks

1. The input time series may include missing values (e.g. NaN) at either end, but they will not be included in the calculations.
2. The input time series must be homogeneous or equally spaced.
3. The first value in the input time series must correspond to the earliest observation.
4. The frequency component order, k, must be a positive number less than N, or the error (#VALUE!) is returned.
5. The DFT returns the phase angle in radians, i.e. $0 \lt \phi \lt 2 \times \pi$.
6. The discrete **Excel Fourier** transformation (DFT) is defined as follows: $$ X_k = \sum_{j=0}^{N-1} x_j e^{-\frac{2\pi i}{N} j k} $$ Where:
   - k is the frequency component
   - $x_0,...,x_{N-1}$ are the values of the input time series
   - N is the number of non-missing values in the input time series
7. The Cooley-Tukey radix-2 decimation-in-time fast Excek Fourier transform (FFT) algorithm divides a DFT of size N into two overlapping DFTs of size $\frac{N}{2}$ at each of its stages using the following formula: $$ X_{k} = \begin{cases} E_k + \alpha \cdot O_k & \text{ if } k \lt \dfrac{N}{2} \\ E_{\left (k-\frac{N}{2} \right)} - \ \alpha \cdot O_{\left (k-\frac{N}{2} \right)} & \text{ if } k \geq \dfrac{N}{2} \end{cases} $$ Where:
   - E_k is the DFT of the even-indicied values of the input time series, $x_{2m} \left(x_0, x_2, \ldots, x_{N-2}\right)$
   - O_k is the DFT of the odd-indicied values of the input time series, $x_{2m+1} \left(x_1, x_3, \ldots, x_{N-2}\right)$
   - $\alpha = e^{ \left (-2 \pi i k /N \right)}$,
   - N is the number of non-missing values in the time series data.
8. The unit frequency of the DFT is $\frac{2\pi}{N}$, where N is the number of non-missing observations.

Exceptions

Exception Type	Condition
None	N/A

Requirements

Namespace	NumXLAPI
Class	SFSDK
Scope	Public
Lifetime	Static
Package	NumXLAPI.DLL

Examples

References

Hamilton, J .D.; Time Series Analysis , Princeton University Press (1994), ISBN 0-691-04289-6

Tsay, Ruey S.; Analysis of Financial Time Series John Wiley & SONS. (2005), ISBN 0-471-690740

See Also

[template("related")]