# scipy.signal

https://docs.scipy.org/doc/scipy/tutorial/signal.html

## B-splines

## Filtering

### Convolution/correlation

`convolve()`: 1-D convolution

### Difference-equation filtering

#### Analysis of linear systems

`tf2zpk()`

`zpk2tf()`

### Filter design

#### FIR filter

#### IIR filter

#### Filter coefficient formats

Filter coefficients can be stored as

* ‘ba’ or ‘tf’: transfer function coefficients
* ‘zpk’: zeros, poles, gain
* ‘ss’: state-space system representation
* ‘sos’: transfer function coefficients of second-order sections

These functions convert between representations: <https://docs.scipy.org/doc/scipy/reference/signal.html#lti-representations>

**Transfer function representation:**

‘ba’ or ‘tf’ is a 2-ple (b, a)

* b is an (M+1)-length array of coefficients of the M-order numerator polynomial
* a is an (N+1)-length array of coefficients of the N-order denominator

Represents analog or discrete-time filters:

The discrete-time transfer function is represented “positive” powers, which is typically found in controls engineering.

In DSP, the transfer function is typically represented as negative powers:

The two representations are equal if , but be careful when .

Transfer function representation suffers from numerical error at higher orders, so other formats are preferred when possible.

**Zeros and poles representation:**

#### Filter transformations

### Other filters

### Analog filter design