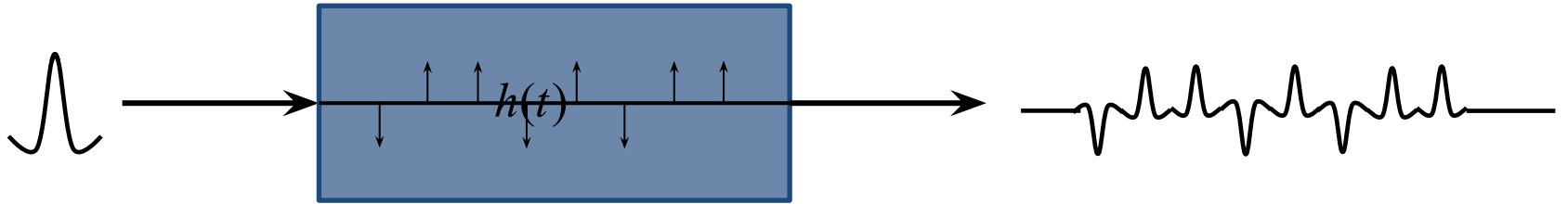


Convolution (Свертка)
(Фильтрация)

Deconvolution (???)
(Деобратная)
фильтрация)
фильтрация)

Convolution



$$\text{Input Signal} * \text{Impulse Response} = \text{Output Signal}$$

The diagram shows the mathematical representation of convolution. On the left, a smooth, bell-shaped curve is followed by an asterisk symbol (*). This is followed by an equals sign (=) and a complex, jagged waveform, which is identical to the output signal shown in the diagram above.

Convolution

$$x(t) * h(t) = y(t)$$

$$y(t) = \int_0^t x(\tau) \cdot h(t - \tau) d\tau$$

$$c_k = \sum_{j=0}^n a_{k-j} b_j \quad n = N + M - 1$$

Convolution

$$x(t) * h(t) = y(t)$$

$$X(\omega) \cdot H(\omega) = Y(\omega)$$

Deconvolution

$$y(t) * h^{-1}(t) = x(t)$$

$$Y(\omega) \cdot H^{-1}(\omega) = X(\omega)$$

$$x(t) \xleftrightarrow{F} X(\omega)$$

$$y(t) \xleftrightarrow{F} Y(\omega)$$

$$h(t) \xleftrightarrow{F} H(\omega)$$

$$h^{-1}(t) \xleftrightarrow{F} H^{-1}(\omega)$$

$$H^{-1}(\omega) \cdot H(\omega) = 1$$

Convolution -Deconvolution

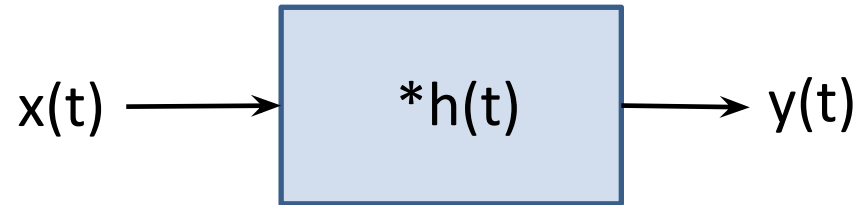
$$x(t) * h(t) = y(t)$$

$$X(\omega) \cdot H(\omega) = Y(\omega)$$

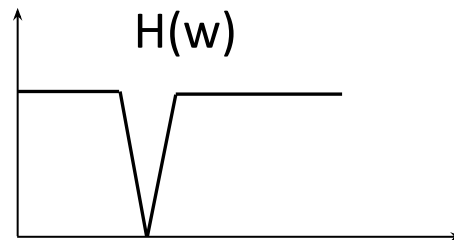
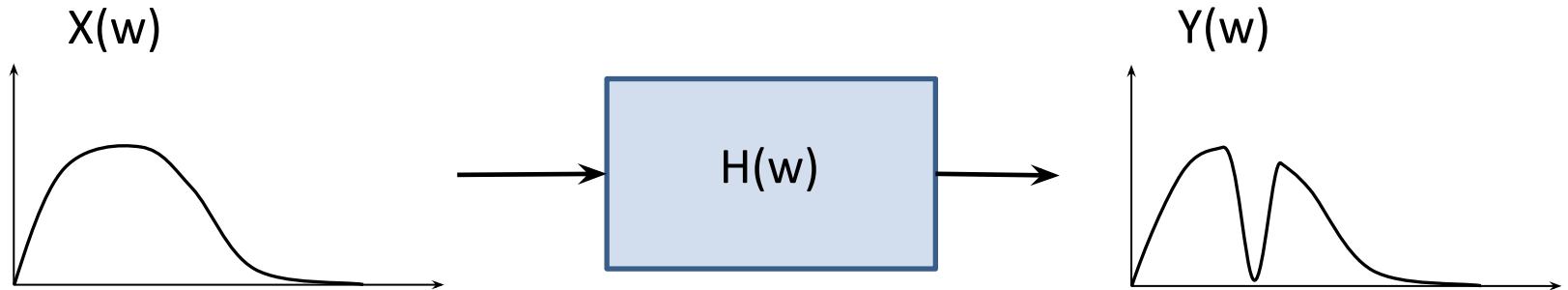
$$H(\omega) = \frac{Y(\omega)}{X(\omega)}$$

$$H^{-1}(\omega) = \frac{X(\omega)}{Y(\omega)}$$

Convolution – Deconvolution

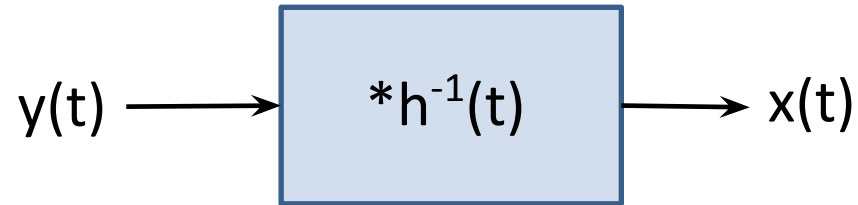


Time domain

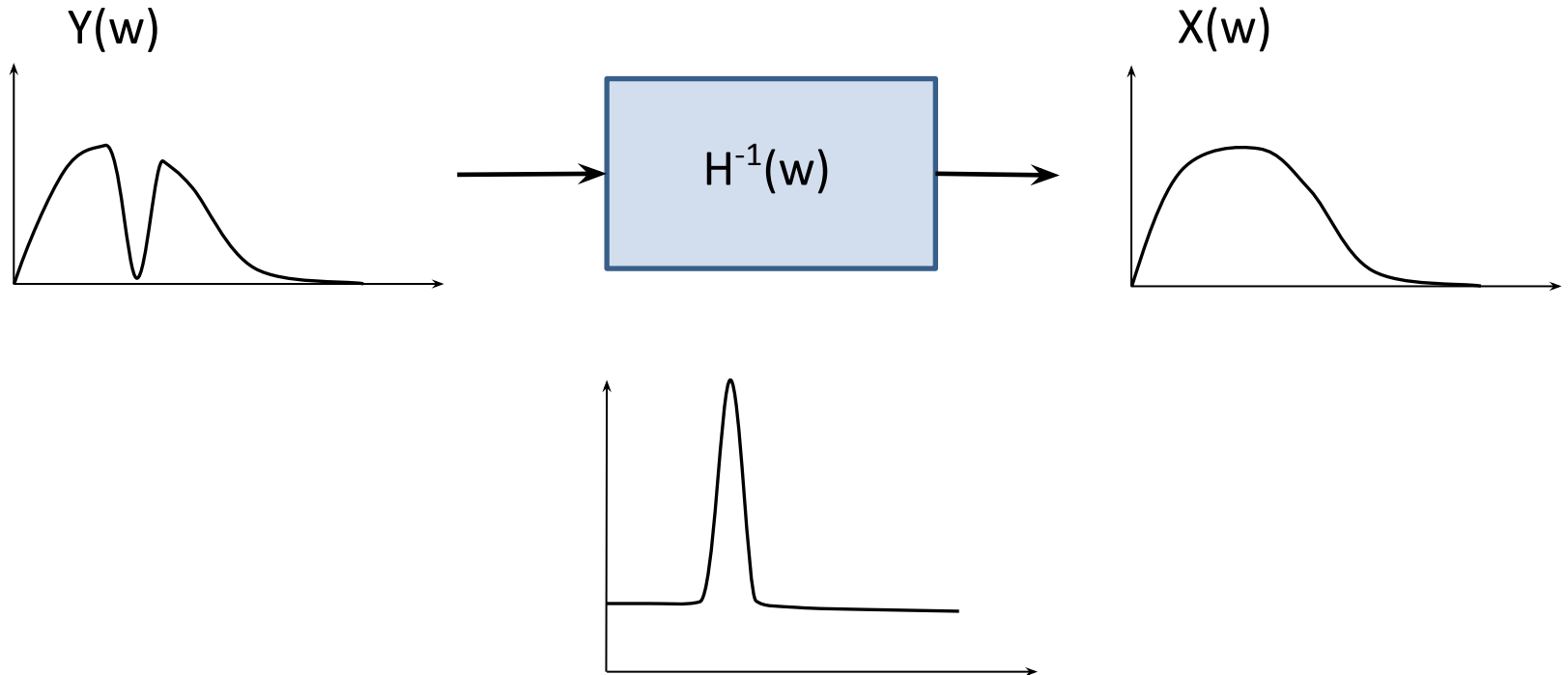


Frequency domain

Convolution – Deconvolution



Time domain



Frequency domain

Convolution (Свертка)

$$x(t) * h(t) = y(t)$$

$$X(\omega) \cdot H(\omega) = Y(\omega)$$

Deconvolution

$$y(t) * h^{-1}(t) = x(t)$$

$$Y(\omega) \cdot H^{-1}(\omega) = X(\omega)$$

$$x(t) \xleftrightarrow{F} X(\omega)$$

$$y(t) \xleftrightarrow{F} Y(\omega)$$

$$h(t) \xleftrightarrow{F} H(\omega)$$

$$h^{-1}(t) \xleftrightarrow{F} H^{-1}(\omega)$$

$$H^{-1}(\omega) \cdot H(\omega) = 1$$

Метод наименьших квадратов (МНК, Ordinary Least Squares, OLS)

$$L = \sum_{k=0}^n [x_k - y_k * f_k]^2 \rightarrow \min \quad f_k \rightarrow h_k$$

$$\begin{cases} \frac{\partial L}{\partial f_k} = 0 \end{cases}$$

$$y_k = (1; -\frac{1}{2})$$

$$x_k = (1; 0; 0)$$

$$f_k = (f_1; f_2)$$

Задание домой

По трем точка получить уравнение параболы. Парабола выбирается каждым самостоятельно. Решение принести с собой.