ZPRACOVÁNÍ A ANALÝZA BIOSIGNÁLŮ

MU

IBA

KONVOLUCE

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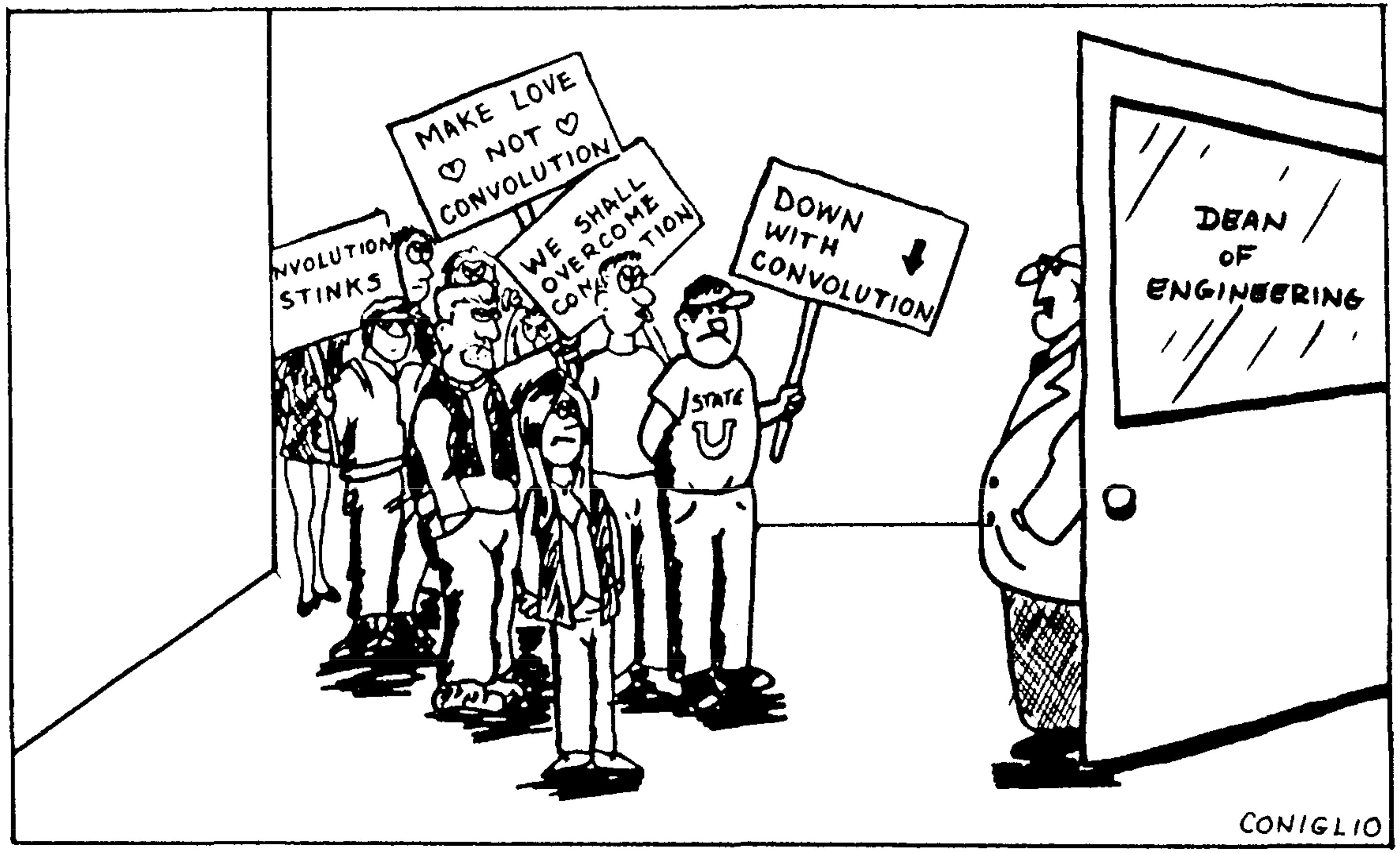

Convolution: its bark is worse than its bite!

KONVOLUCE

- ☑ spojité signály

$$s_1(t) * s_2(t) = \int_{-\infty}^{t} s_1(x).s_2(t-x).dx \approx S_1(\omega).S_2(\omega)$$

- ☑ diskrétní signály

$$s_1(n) * s_2(n) = \sum_{i=0}^{n} s_1(i).s_2(n-i) \approx S_1(z).S_2(z)$$

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$$s_1(t) * s_2(t) = \int_{-\infty}^{\infty} s_1(\tau).s_2(t-\tau).d\tau =$$

$$= \int_{-\infty}^{\infty} s_1(t-\tau).s_2(\tau).d\tau \qquad \approx S_1(\omega).S_2(\omega)$$

Důkaz:

$$s_1(t) * s_2(t) = \int_{-\infty}^{\infty} s_1(\tau).s_2(t-\tau).d\tau = \begin{vmatrix} x = t-\tau \\ \tau = t - x \\ d\tau = -dx \end{vmatrix} =$$

$$= -\int_{\infty}^{-\infty} s_2(x).s_1(t-x).dx = s_2(t) * s_1(t)$$

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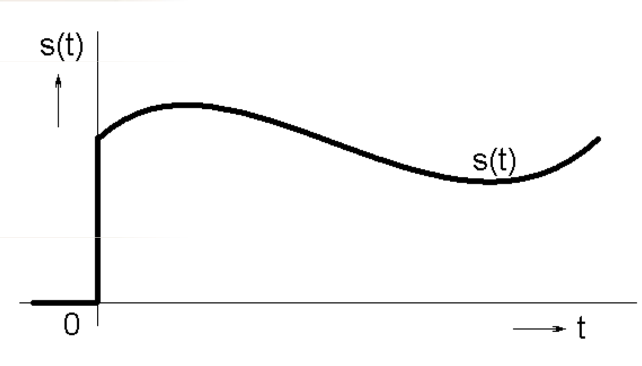
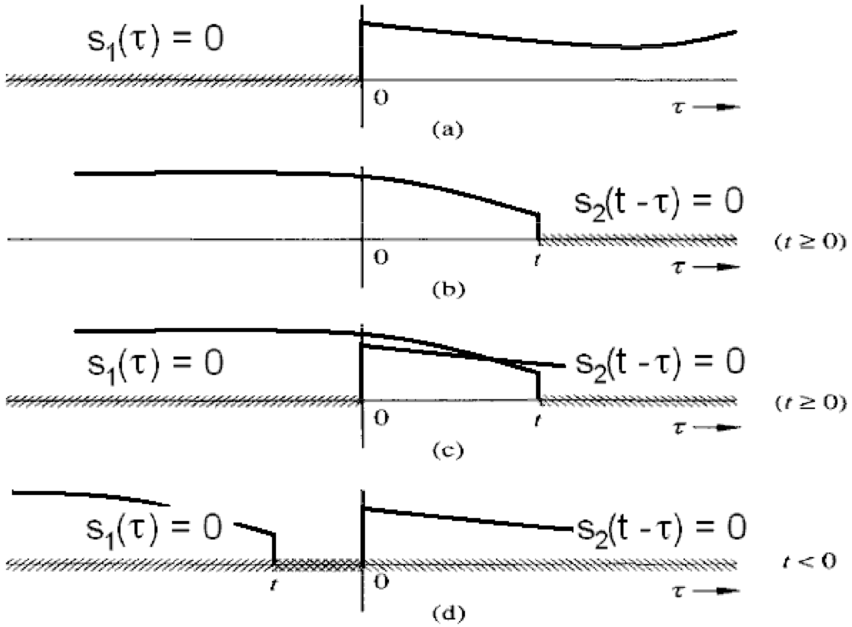
Konvoluce kauzálních signálů:

- pro kauzální signály platí s(t) = 0 pro t < 0





$$s_1(t) * s_2(t) = \int_0^t s_1(\tau).s_2(t-\tau).d\tau$$

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Distributivní zákon:

$$f_1(t) * [f_2(t) * f_3(t)] = [f_1(t) * f_2(t)] * f_3(t)$$

Asociativní zákon:

$$f_1(t) * [f_2(t) + f_3(t)] = f_1(t) * f_2(t) + f_1(t) * f_3(t)$$

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Zákon o posunu v čase:

Je – li

$$f_1(t) * f_2(t) = c(t),$$

pak

$$f_1(t) * f_2(t - T) = c(t - T),$$

$$f_1(t - T) * f_2(t) = c(t - T)$$

a

$$f_1(t - T_1) * f_2(t - T_2) = c(t - T_1 - T_2)$$

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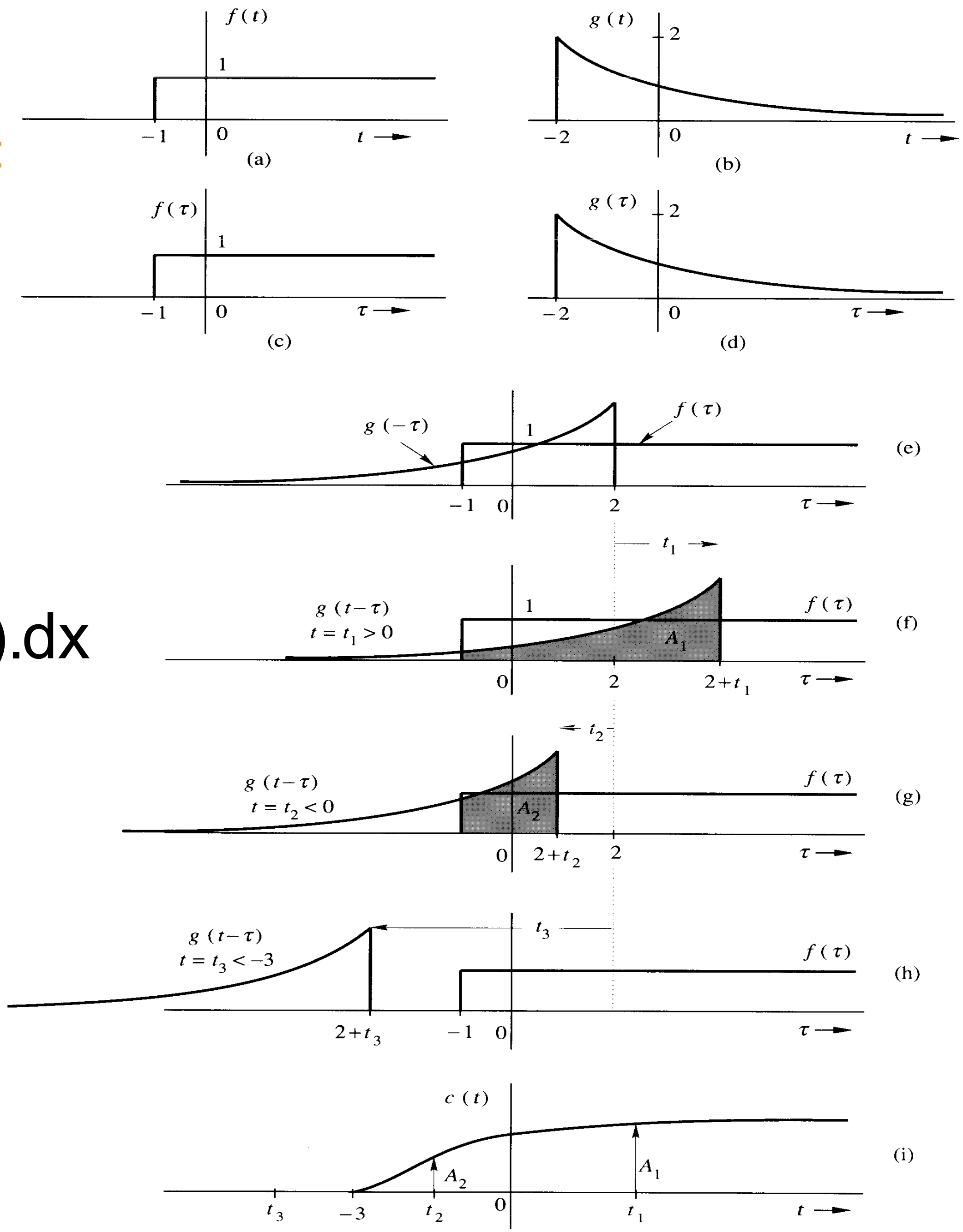
$$s_1(t) * s_2(t) = \int_{-\infty}^{t} s_1(x).s_2(t-x).dx$$



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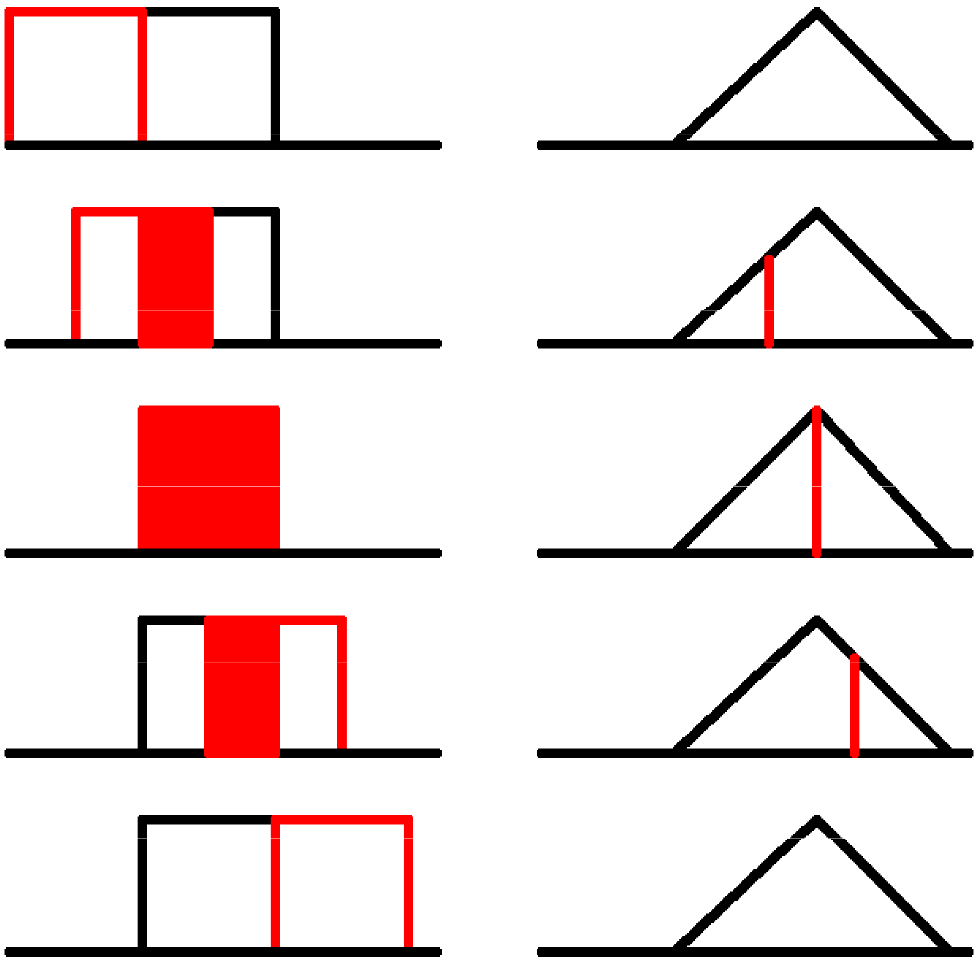


KONVOLUCE

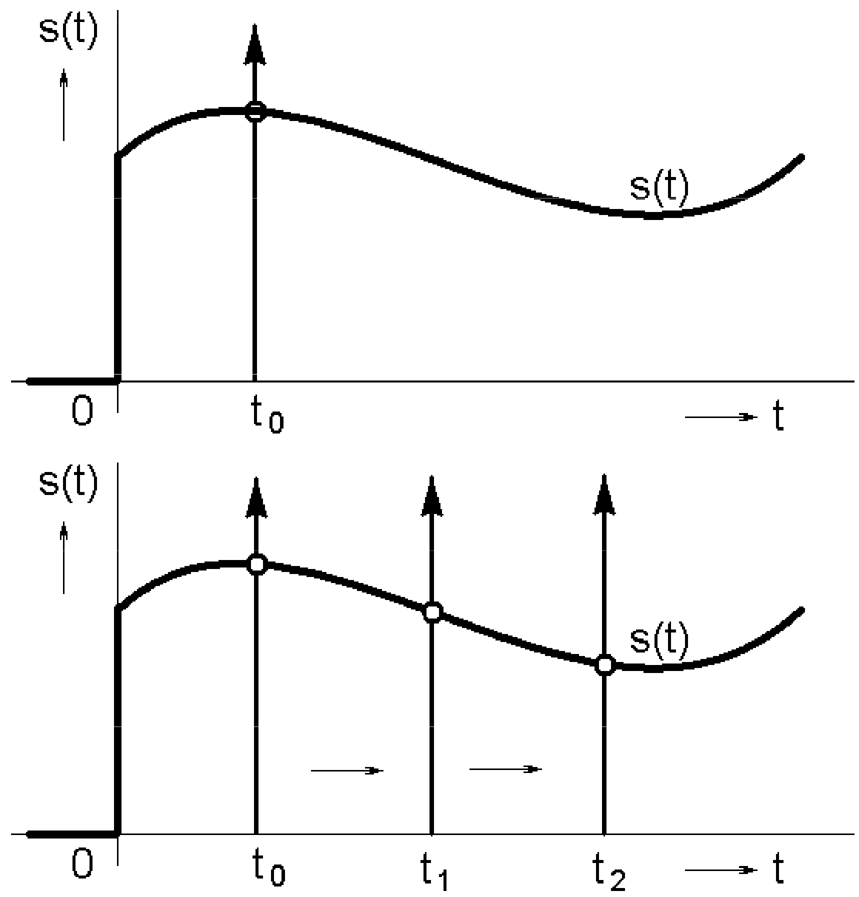
signálu s jednotkovým impulsem

definice:

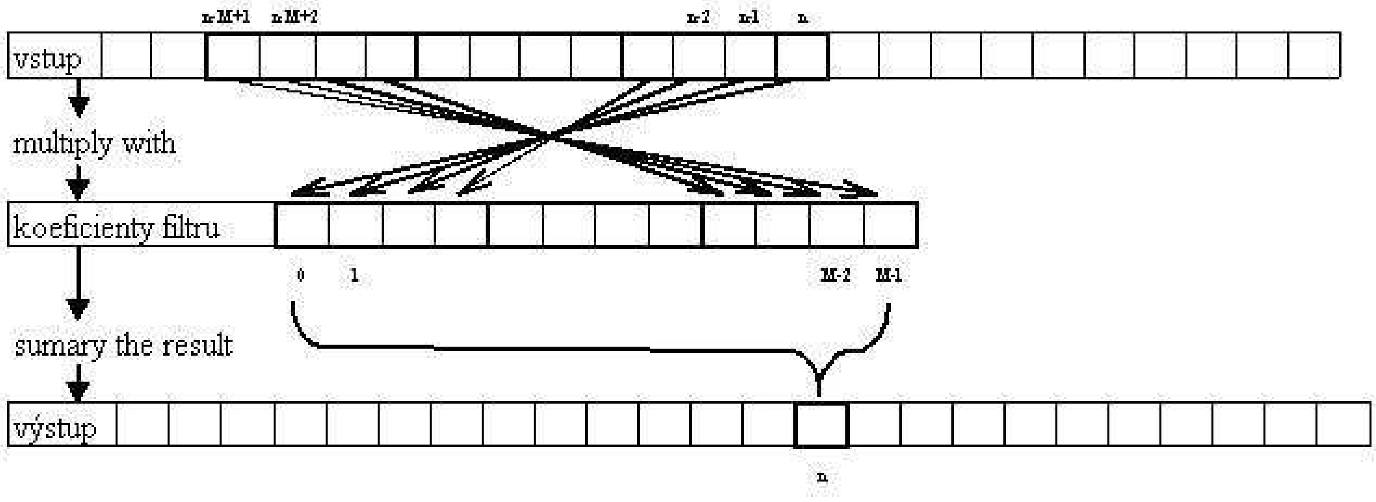
$$\int_{-\infty}^{\infty} s(t).\delta(t-t_0)dt = s(t_0)$$

konvoluce:

$$s(t) * \delta(t) = \int_{-\infty}^{\infty} s(t).\delta(t-\tau)d\tau = s(t)$$



DISKRÉTNÍ KONVOLUCE



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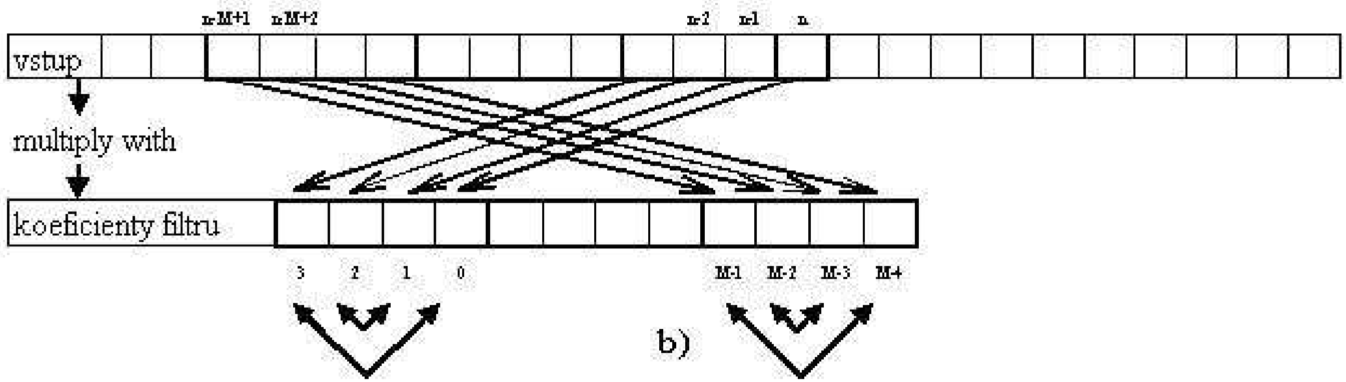

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