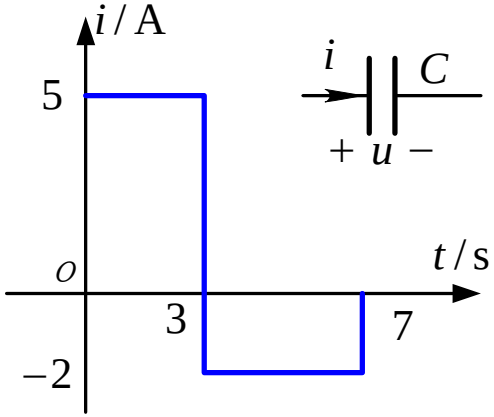
电容元件

例1 设0.2F电容流过的电流波形如图所示，已知$u(0)=30\text{V}$。试计算电容电压的变化规律并画出波形。



解： 电容电压计算如下

(1) $0 \le t < 3\text{s}$: $i = 5\text{A} > 0$ 电容充电

$$u = u(0) + \frac{1}{C}\int_0^t i(\xi)\mathrm{d}\xi$$

$$= 30\text{V} + \frac{1}{0.2\text{F}}\int_0^t 5\text{A}\mathrm{d}\xi = 30\text{V} + 25t$$

并且 $u(3\text{s}) = (30 + 25\times 3)\text{V} = 105\text{V}$

(2) $3\text{s} \le t < 7\text{s}$: $i = -2\text{A} < 0$

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$$u = u(3\text{s}) + \frac{1}{C}\int_{3\text{s}}^{t} i(\xi)\mathrm{d}\xi = 105 + \frac{1}{0.2}\int_{3\text{s}}^{t}(-2)\mathrm{d}\xi = (135 - 10t)\text{V}$$

并且 $u(7\text{s}) = 65\text{V}$

(3) $t \geq 7\text{s}$: $i = 0\text{A}$

电容电压保持不变

$u(t) = u(7\text{s}) = 65\text{V}$