通信1401班

史文惠.

规律总结：

1. 连续正弦信号sinωt一定是周期信号，而正弦序列sinβk不一定是周期序列

2、两连续周期信号之和不一定是周期信号. 而两连续周期序列之和一定是周期序列

3. 连续信号⟷模拟信号

4. 数字信号→离散信号

5、$x(t)$周期为T_1.
$y(t)$周期为T_2.
$x(t)+y(t)$：

$\begin{cases}(1).若\ T_1/T_2为有理数\ 则为周期信号\\(2).若\ T_1/T_2为无理数\ 则为非周期信号\end{cases}$

周期 = $T_1 \cdot T_2$ / T_1&T_2最小公倍数

6. 如何求离散信号周期：

(1). N为整数, $T=N$.

(2). N为有理数. $T=mN$

(3). N为无理数. 非周期序列

2016.03.26 ，习题一

第一章 信号与系统

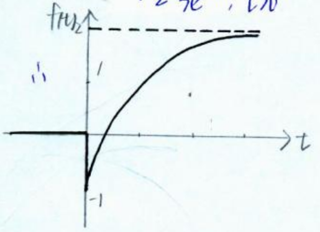
1-1、画出下列各信号的波形[式中$r(t)=t\varepsilon(t)$为斜升函数]

(1)、$f(t)=(2-3e^{-t})\,\varepsilon(t)$

解：$\varepsilon(t)=\begin{cases}0, & t<0\\ \frac{1}{2}, & t=0\\ 1, & t>0\end{cases}$

$\therefore f(t)=\begin{cases}0, & t<0\\ 1-\frac{3e^{-t}}{2}, & t=0\\ 2-3e^{-t}, & t>0\end{cases}$

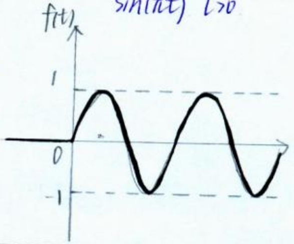
∴



(3). $f(t)=\sin(\pi t)\varepsilon(t)$

解：$\varepsilon(t)=\begin{cases}0, & t<0\\ \frac{1}{2}, & t=0\\ 1, & t>0\end{cases}$

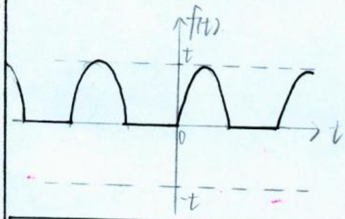
$\therefore f(t)=\begin{cases}0, & t<0\\ \frac{1}{2}\sin(\pi t), & t=0\\ \sin(\pi t) & t>0\end{cases}$



(5). $f(t)=r(\sin t)$.

解：$r(t)=t\varepsilon(t)=\begin{cases}0, & t<0\\ \frac{t}{2}, & t=0\\ t, & t>0\end{cases}$

$\therefore f(t)=\begin{cases}0, & t<0\\ \frac{t}{2}\sin t, & t=0\\ t\sin t, & t>0\end{cases}$

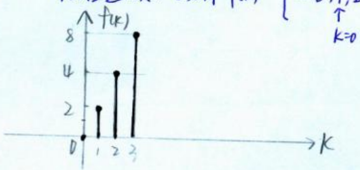


(7). $f(k)=2^k\varepsilon(k)$.

解：$\varepsilon(k)=\begin{cases}0, & k<0\\ 1, & t\geq 0\end{cases}$

$\therefore f(k)=\begin{cases}0, & k<0\\ 2^k, & k\geq 0\end{cases}$

!! 该表达式为离散序列. 时间离散. 但幅值连续. 故有 $f(k)=\{\cdots 0,\underset{\underset{k=0}{\uparrow}}{1},2,4,8,\cdots$



(9). $f(k)=\sin(\frac{k\pi}{4})\varepsilon(k)$.

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马

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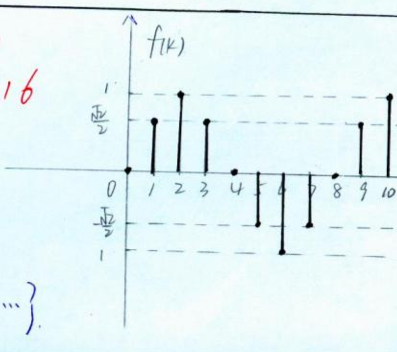
解：$\varepsilon(k)=\begin{cases}0, & k<0\\ 1, & k\geq 0\end{cases}$

$\therefore f(k)=\begin{cases}0. & k<0\\ \sin(\frac{k\pi}{4}). & k\geq 0.\end{cases}$

对于$\sin\frac{k\pi}{4}$，$N=\frac{2\pi}{\frac{k\pi}{4}}\times m=8$.

$\therefore f(k)=\{0,\underset{\underset{k=0}{\uparrow}}{0},\frac{\sqrt{2}}{2},1,\frac{\sqrt{2}}{2},0,-\frac{\sqrt{2}}{2},\cdots\}$.



第一章. 信号与系统.　电子信息工程1403 袁佳

1.1. 画出下列各信号的波形 [式中 $r(t) = t\varepsilon(t)$ 为斜升函数]

(1) $f(t)=(2-3e^{-t})\varepsilon(t)$

(3) $f(t)=\sin(\pi t)\varepsilon(t)$

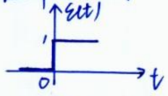
(5) $f(t)=r(\sin t)$

(7) $f(k)=2^{k}\varepsilon(k)$

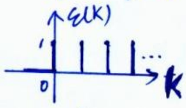
(8) $f(k)=\sin(\frac{k\pi}{4})\varepsilon(k)$

知识点

单位阶跃函数:



$$\varepsilon(t)=\begin{cases}0 & t<0\\ 1 & t>0\end{cases}$$

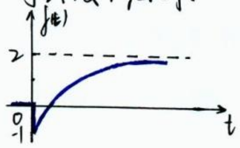


$$\varepsilon(k)=\begin{cases}0 & k<0\\ 1 & k\geq 0.\end{cases}$$

(1) 由 $\varepsilon(t)$ 的定义, $f(t)$ 可写为

$$f(t)=\begin{cases}2-3e^{-t} & t>0\\ 0 & t<0\end{cases}$$

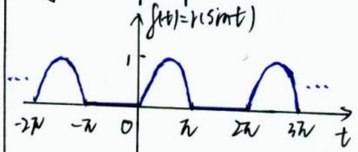
则其波形如下:



(5) 由 $\varepsilon(t)$ 的定义知 $f(t)$ 可写为

$$f(t)=r(\sin t)=\begin{cases}\sin t & (\sin t\geq 0)\\ 0 & (\sin t\leq 0)\end{cases}$$

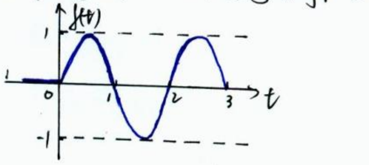
则其波形如下:



(3) 据 $\varepsilon(t)$ 的定义, $f(t)$ 可写为:

$$f(t)=\begin{cases}\sin(\pi t) & t>0\\ 0 & t<0\end{cases}$$

由于 $=\frac{2\pi}{\omega}$ 知 $\sin(\pi t)$ 的周期 $T=2$

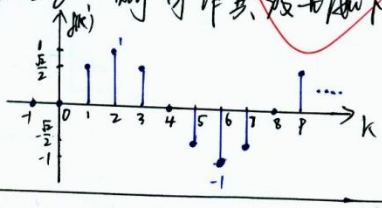


(7) 由 $\varepsilon(k)$ 的定义, $f(k)$ 可写为

$$f(k)=\begin{cases}2^{k} & k\geq 0\\ 0 & k<0\end{cases}$$

则画出其波形如下:

(8). $f(k)$ 可写为 $f(k)=\begin{cases}\sin(\frac{k\pi}{4}) & k\geq 0\\ 0 & k<0\end{cases}$ 由于 $\frac{2\pi}{\omega}$ 知 $\sin(\frac{k\pi}{4})$ 的周期 $N=\frac{2\pi}{\frac{\pi}{4}}=8$, 则可作其波形如下:



1.2. 画下列各信号的波形 [式中 $r(t)=t\varepsilon(t)$ 为斜升函数]

(1) $f(t)=2\varepsilon(t+1))-3\varepsilon(t-1)+\varepsilon(t-2)$

(3) $f(t)=\varepsilon(t)r(2-t)$

(5) $f(t)=r(2t)\varepsilon(2-t)$

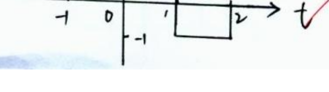
(7) $f(t)=\sin\pi(t-1)[\varepsilon(2-t)-\varepsilon(-t)]$

(8) $f(k)=2^{-k}\varepsilon(k)$

(1). 信号 $f(t)=2\varepsilon(t+1)-3\varepsilon(t-1)+\varepsilon(t-2)$ 是经过阶跃函数的平移再合成, 由此可知其表达式可写为:

$$f(t)=\begin{cases}0 & t<-1\\ 2 & -1<t<1\\ 2-3=-1 & 1<t<2\\ -1+1=0 & t>2.\end{cases}$$

据此表达式可作图如下:



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张译月

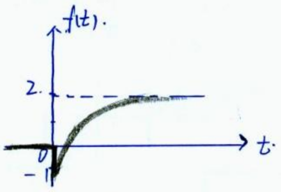
第一章 信号与系统

1.1 画出下列各信号的波形[式中 $r(t)=t\varepsilon(t)$ 为斜升函数].

(1) $f(t)=(2-3e^{-t})\varepsilon(t)$.

解：由 $\varepsilon(t)=\begin{cases}0 & t<0\\ 1 & t>0\end{cases}$ 可知.

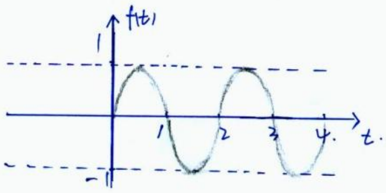
$$f(t)=\begin{cases}0 & t<0\\ 2-3e^{-t} & t>0\end{cases}.$$



(3) $f(t)=\sin(\pi t)\varepsilon(t)$

解：~~ε(t)~~ 由 $\varepsilon(t)$ 定义知.

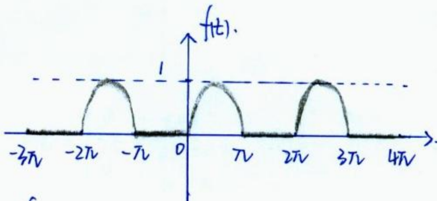
$$f(t)=\begin{cases}0 & t<0\\ \sin(\pi t) & t>0.\end{cases}$$



(5) $f(t)=r(\sin t)$.

解：$r(t)=t\varepsilon(t)=\begin{cases}0 & t<0\\ t & t>0.\end{cases}$

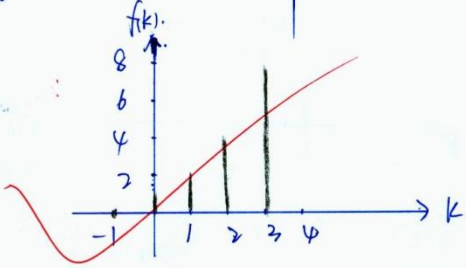
$$f(t)=\begin{cases}0, & \sin t<0\\ \sin t, & \sin t>0.\end{cases}$$



(7) $f(k)=2^{k}\varepsilon(k)$.

解：由 $\varepsilon(k)$ 定义知.

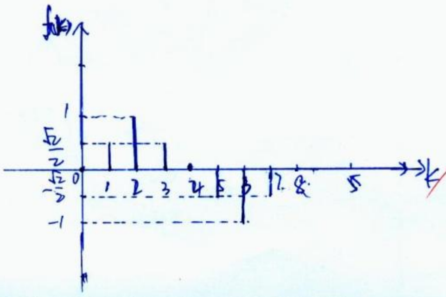
$$f(k)=\begin{cases}0, & k<0\\ 2^{k}, & k>0\end{cases}$$



(9) $f(k)=\sin(\frac{k}{4}\pi)\varepsilon(k)$.

由 $\varepsilon(k)$ 定义知 $f(k)=\begin{cases}\sin(\frac{k}{4}\pi), & k>0\\ 0 & k<0\end{cases}$

$\beta=\frac{\pi}{4}$, $N=\frac{2\pi}{\beta}=8$.



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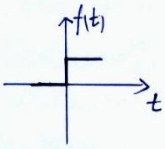


单位阶跃函数

$\varepsilon(t)=\begin{cases}1, & t>0\\ 0, & t<0\end{cases}$

t=0处，发生跳变

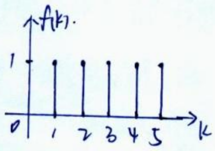
① 连续时间信号.

单位阶跃函数定义为

$\varepsilon(t)\overset{def}{=}\begin{cases}0, & t<0\\ 1, & t>0.\end{cases}$

② 离散时间信号.

样值：第m个样点的值.



单位阶跃序列.

$\varepsilon(k)=\begin{cases}0, & k<0\\ 1, & k\geq0\end{cases}$

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知识点整理

① 单位阶跃函数定义为

$$\varepsilon(t) \overset{\text{def}}{=} \begin{cases} 0, & t<0 \\ 1, & t>0 \end{cases}$$

② 离散时间信号

$$\varepsilon(k) = \begin{cases} 0, & k<0 \\ 1, & k\geqslant 0 \end{cases}$$

称为单位阶跃序列.

③ 离散信号表达式<1>

$$f_1(k) = \begin{cases} 0, & k<-1 \\ 1, & k=-1 \\ 2, & k=0 \\ 0.5, & k=1 \\ -1, & k=2 \\ 0, & k>2 \end{cases}$$

表达方式<2>

$$f(k) = \{0, \underset{\substack{\uparrow \\ k=0}}{1}, 2, \cdots\}$$

第一章 信号与系统

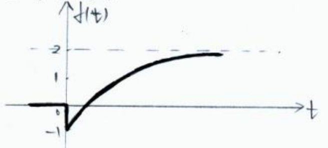
习题一

1.1 画出下列各信号的波形[式中 $r(t) = t\varepsilon(t)$]为斜升函数.

(1) $f(t) = (2-3e^{-t})\varepsilon(t)$

解：由题设 $\varepsilon(t) = \begin{cases} 0, & t<0 \\ 1, & t\geqslant 0 \end{cases}$，则 $f(t)$ 可写为 $f(t) = \begin{cases} 2-3e^{-t}, & t\geqslant 0 \\ 0, & t<0 \end{cases}$

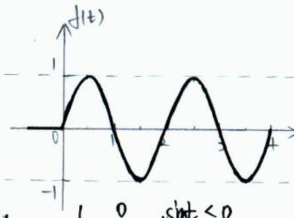
则波形为



(3) $f(t) = \sin(\pi t)\varepsilon(t)$

解：$f(t)$ 可表示为 $f(t) = \begin{cases} 0, & t<0 \\ \sin(\pi t), & t\geqslant 0 \end{cases}$，则波形为

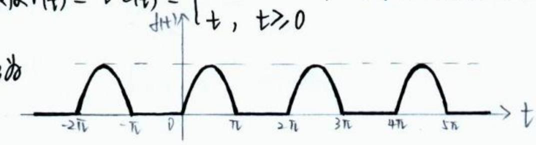
$T = \frac{2\pi}{\pi} = 2$.



(5) $f(t) = r(\sin t)$

解：由题设 $r(t) = t\varepsilon(t) = \begin{cases} 0, & t<0 \\ t, & t\geqslant 0 \end{cases}$，则 $f(t)$ 可表示为 $f(t) = \begin{cases} 0, & \sin t<0 \\ \sin t, & \sin t\geqslant 0 \end{cases}$

则波形为



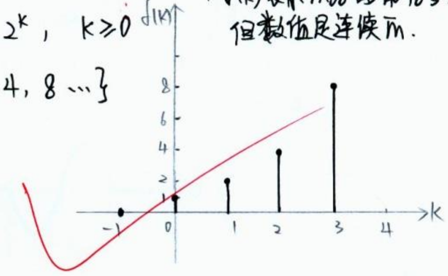
(7) $f(k) = 2^k\varepsilon(k)$

解：$f(k)$ 可表示为 $f(k) = \begin{cases} 0, & k<0 \\ 2^k, & k\geqslant 0 \end{cases}$

∵ $f(k)$ 表示的为离散信号，即时间为离散的但数值是连续的.

$\therefore f(k) = \{0, \underset{\substack{\uparrow \\ k=0}}{1}, 2, 4, 8 \cdots\}$

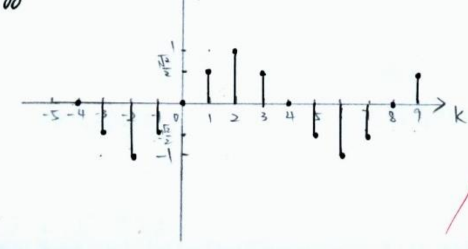
则波形为



(9) $f(k) = \sin(\frac{k\pi}{4})\varepsilon(k)$

解：$f(k)$ 可表示为 $f(k) = \begin{cases} 0, & k<0 \\ \sin(\frac{k\pi}{4}), & k\geqslant 0 \end{cases}$ ∵ $f(k)$ 表示的为离散信号

∴波形为



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第一章 信号与系统

电气与自动化学院
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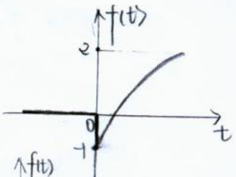
王婷
20141704$5$

1.1 画出下列各信号的波形[式中$r(t)=t\varepsilon(t)$为斜升函数].

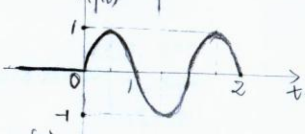
(1) $f(t)=(2-3e^{-t})\varepsilon(t)$

解：由$\varepsilon(t)=\begin{cases}0, & t<0\\ \frac{1}{2}, & t=0\\ 1, & t>0\end{cases}$ 可得 $f(t)=\begin{cases}0, & t<0\\ 1-\frac{3}{2}e^{-t}, & t=0\\ 2-3e^{-t}, & t>0\end{cases}$ 故有.



(3) $f(t)=\sin(\pi t)\varepsilon(t)$.

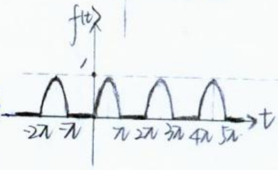
解：由$\varepsilon(t)=\begin{cases}0, & t<0\\ \frac{1}{2}, & t=0\\ 1, & t>0\end{cases}$ 可得. $f(t)=\begin{cases}0, & t<0\\ \frac{1}{2}\sin(\pi t), & t=0\\ \sin(\pi t), & t>0\end{cases}$、故有、



(5). $f(t)=r\sin(t)$

解：$f(t)=r\sin(t)=t\varepsilon(t)\sin(t)$

由$\varepsilon(t)=\begin{cases}0, & t<0\\ \frac{1}{2}, & t=0\\ 1, & t>0\end{cases}$ 可知、$f(t)=\begin{cases}0, & \sin t<0\\ \frac{1}{2}\sin t, & \sin t=0\\ \sin t, & \sin t>0\end{cases}$. 故有

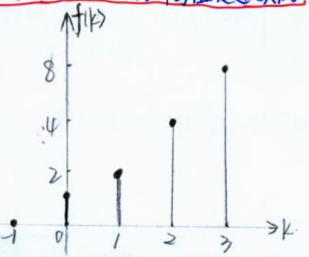


(7) $f(k)=2^{k}\cdot\varepsilon(t)$

解：由$\varepsilon(k)=\begin{cases}0, & k<0\\ 1, & k\geq 0\end{cases}$ 可知 $f(k)=\begin{cases}0, & k<0\\ 2^{k}, & k\geq 0\end{cases}$

又∵该表达式为离散信号,时间是离散的,但幅值是连续的.

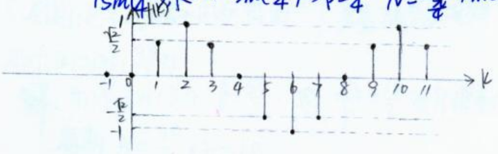
即有 $f(k)=\{\cdots 0,\underset{\substack{\uparrow\\ k=0}}{1},2,4,\cdots\}$ 故有



(9). $f(k)=\sin(\frac{k\pi}{4})\varepsilon(k)$

解：由$\varepsilon(k)=\begin{cases}0, & k<0\\ 1, & k\geq 0\end{cases}$

有 $f(k)=\begin{cases}0, & k<0\\ \sin(\frac{k\pi}{4}), & k\geq 0.\end{cases}$ $\sin(\frac{k\pi}{4})\rightarrow\beta=\frac{\pi}{4}$ $N=\frac{2\pi}{\frac{\pi}{4}}\times m=8$ 即 $f(k)=\{0.\underset{\substack{\uparrow\\ k=0.}}{0}.\frac{\sqrt{2}}{2},1,\frac{\sqrt{2}}{2},0,-\frac{\sqrt{2}}{2}\cdots\}$

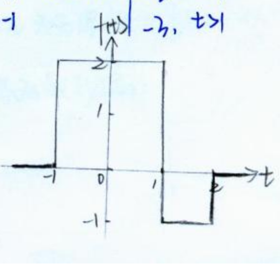


1.2. 画出下列各信号的波形[式中$r(t)=t\varepsilon(t)$为斜升函数].

(1) $f(t)=2\varepsilon(t+1)-3\varepsilon(t-1)+\varepsilon(t-2)$

解：由$\varepsilon(t)=\begin{cases}1, & t>0\\ \frac{1}{2}, & t=0\\ 0, & t<0\end{cases}$ 可得. $2\varepsilon(t+1)=\begin{cases}0, & t<-1\\ 1, & t=-1\\ 2, & t>-1\end{cases}$ $-3\varepsilon(t-1)=\begin{cases}0, & t<1\\ -\frac{3}{2}, & t=1\\ -3, & t>1\end{cases}$

$\varepsilon(t-2)=\begin{cases}0, & t<2\\ \frac{1}{2}, & t=2\\ 1, & t>2.\end{cases}$ ∴ $f(t)=\begin{cases}0, & t<-1\\ 2, & -1<t<1\\ -1, & 1<t<2\\ 0, & t>2\end{cases}$



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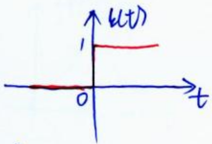
4-2016

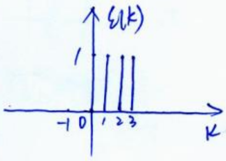
1、单位阶跃函数.

$\varepsilon(t)=\begin{cases}0, & t<0\\ \frac{1}{2}, & t=0\\ 1, & t>0\end{cases}$



离散:

$\varepsilon(k)=\begin{cases}0, & k<0\\ 1, & k\geq 0\end{cases}$



2.积分

$\int_{-\infty}^{t}\varepsilon(t)dt=t\varepsilon(t)$