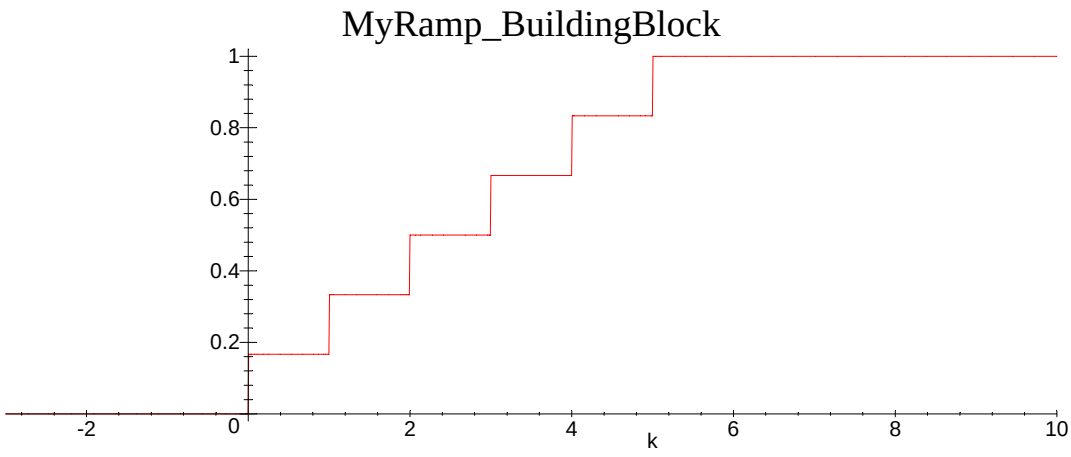
```
STUDENT > # Build mmf profile associated with stator current and
          analyse harmonics
STUDENT > # k = slot number 0..89
STUDENT > # Profile1 = mmf from bottom coils
STUDENT > # Profile2 = mmf from top coils (inverted and shifted by 7
          from Profile1)
STUDENT > # Adding together these two profiles accounts for both
          pitch and distribution factors
STUDENT > # Assume slot width is neglgible and mmf change occurs as
          a step change (typical assumption)
STUDENT > # MyRamp = building block for Profile1 and Profile2
STUDENT > restart;
STUDENT > pi:=evalf(Pi):
STUDENT > MyRamp(k):=(Heaviside(k-j)+Heaviside(k-1-j)+Heaviside(k-2-
          j)+Heaviside(k-3-j)+Heaviside(k-4-j)+Heaviside(k-5-j))/6;
```

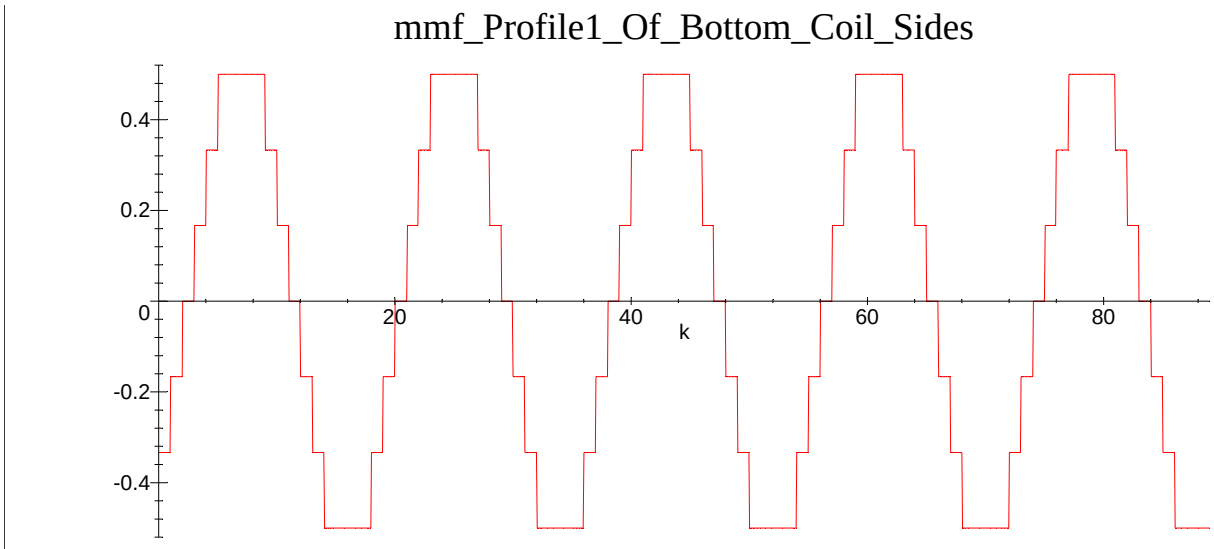
$$\mathrm{MyRamp}(k) := \frac{1}{6}\,\mathrm{Heaviside}(k-j) + \frac{1}{6}\,\mathrm{Heaviside}(k-1-j) + \frac{1}{6}\,\mathrm{Heaviside}(k-2-j)$$

$$+ \frac{1}{6}\,\mathrm{Heaviside}(k-3-j) + \frac{1}{6}\,\mathrm{Heaviside}(k-4-j) + \frac{1}{6}\,\mathrm{Heaviside}(k-5-j)$$

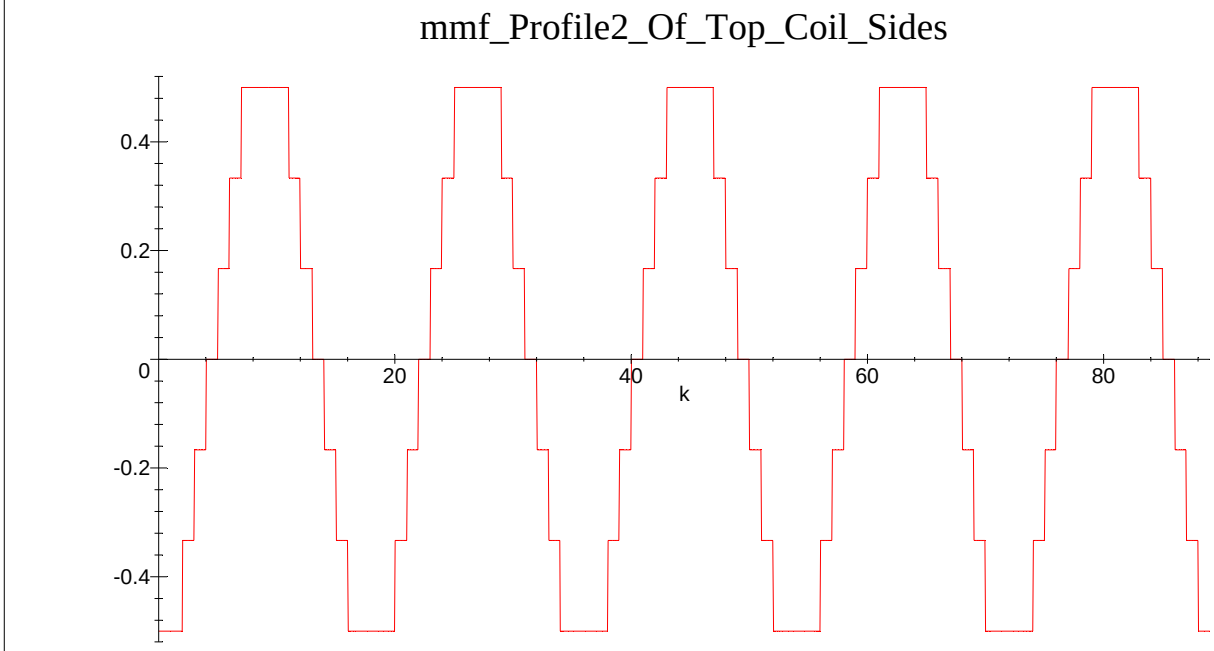
```
STUDENT > plot(subs(j=0,MyRamp(k)),k=-3..10,title='MyRamp_BuildingBl
          ock');
```



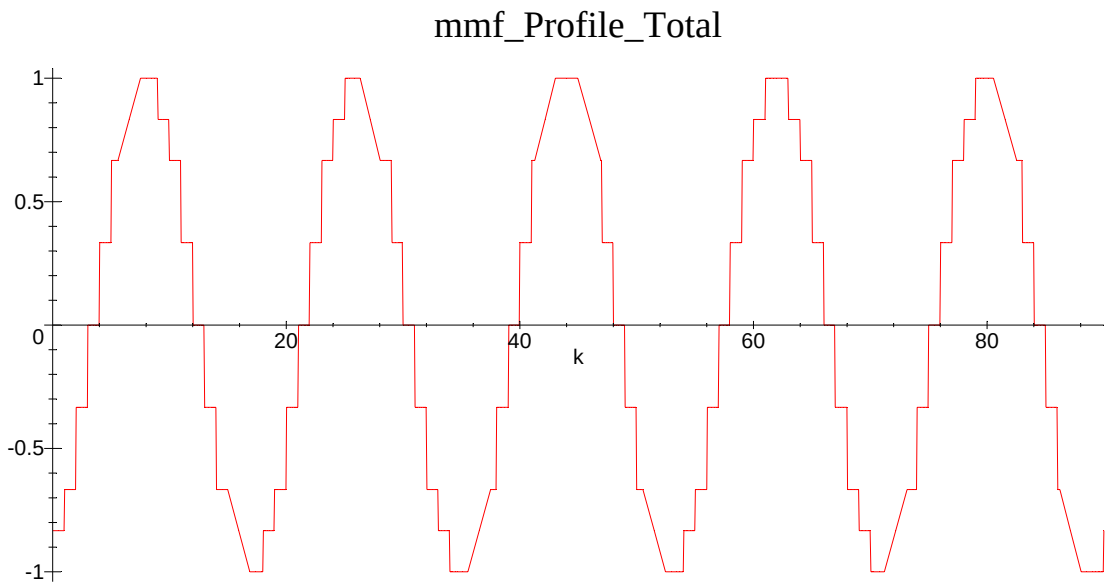

```
STUDENT >
STUDENT > Profile1:=subs(j=0,MyRamp(k))-subs(j=9,MyRamp(k))+subs(j=1
          8,MyRamp(k))-subs(j=27,MyRamp(k))+subs(j=36,MyRamp(k))-sub
          s(j=45,MyRamp(k))+subs(j=54,MyRamp(k))-subs(j=63,MyRamp(k)
          )+subs(j=72,MyRamp(k))-subs(j=81,MyRamp(k))+subs(j=90,MyRa
          mp(k))-0.5:
STUDENT > plot(Profile1,k=0..89,title='mmf_Profile1_Of_Bottom_Coil_S
          ides');
```




```
STUDENT > Profile2:=-1*subs(k=k+7,Profile1):
STUDENT > plot(Profile2,k=0..89,title='mmf_Profile2_Of_Top_Coil_Side
          s');
```




```
STUDENT > ProfileTot:=Profile1+Profile2:
STUDENT > plot(ProfileTot,k=0..90,title='mmf_Profile_Total');
```




```
STUDENT > # Perform Spatial Fourier Analysis of this total waveform.
          Fundamental wave period is 18 slots
STUDENT > A1:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*k/18)*Profil
          eTot,k=0..89)))))/90;
```

$$A1 := .9995677230$$

```
STUDENT > A3:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*3*k/18)*Prof
          ileTot,k=0..89)))))/90;
```

$$A3 := .5578486011\ 10^{-9}$$

```
STUDENT > A5:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*5*k/18)*Prof
          ileTot,k=0..89)))))/90;
```

$$A5 := .009491375323$$

```
STUDENT > A7:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*7*k/18)*Prof
          ileTot,k=0..89)))))/90;
```

$$A7 := .02782589722$$

```
STUDENT > A9:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*9*k/18)*Prof
          ileTot,k=0..89)))))/90;
```

$$A9 := .1241002310\ 10^{-8}$$

```
STUDENT >
STUDENT > A11:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*11*k/18)*Pr
          ofileTot,k=0..89)))))/90;
```

$$A11 := .02782590035$$

```
STUDENT > A13:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*13*k/18)*Pr
          ofileTot,k=0..89)))))/90;
```

$$A13 := .009491376843$$

```
STUDENT > A15:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*15*k/18)*Pr
          ofileTot(k),k=0..89)))))/90;
```

$$A15 := .6140750748\ 10^{-8}$$

```
STUDENT > A17:=2*abs(evalf(simplify(evalc(sum(exp(I*2*pi*17*k/18)*Pr
          ofileTot,k=0..89)))))/90;
```

$$A17 := .9995677208$$

```
STUDENT > # 17th harmonic is same as 1st harmonic.  Expected by
          symmetry properties of fourier transform of a real signal.
STUDENT > # A11, A13, A15 and A17 are a mirror image of A9, A7, A5,
          A3
```