Reproduction of the paper in Qeios (v2.0).

In[ ]:=
```
nwavesbit = 7;
(* Cantidad de puestos disponibles para rellenar -- *)
binaryT = Table[IntegerString[n, 2, nwavesbit], {n, 0, (2^nwavesbit - 1)}]
Length[binaryT]
```

Out[ ]=
```
{0000000, 0000001, 0000010, 0000011, 0000100, 0000101, 0000110, 0000111, 0001000,
 0001001, 0001010, 0001011, 0001100, 0001101, 0001110, 0001111, 0010000, 0010001,
 0010010, 0010011, 0010100, 0010101, 0010110, 0010111, 0011000, 0011001, 0011010,
 0011011, 0011100, 0011101, 0011110, 0011111, 0100000, 0100001, 0100010, 0100011,
 0100100, 0100101, 0100110, 0100111, 0101000, 0101001, 0101010, 0101011, 0101100,
 0101101, 0101110, 0101111, 0110000, 0110001, 0110010, 0110011, 0110100, 0110101,
 0110110, 0110111, 0111000, 0111001, 0111010, 0111011, 0111100, 0111101, 0111110,
 0111111, 1000000, 1000001, 1000010, 1000011, 1000100, 1000101, 1000110, 1000111,
 1001000, 1001001, 1001010, 1001011, 1001100, 1001101, 1001110, 1001111, 1010000,
 1010001, 1010010, 1010011, 1010100, 1010101, 1010110, 1010111, 1011000, 1011001,
 1011010, 1011011, 1011100, 1011101, 1011110, 1011111, 1100000, 1100001, 1100010,
 1100011, 1100100, 1100101, 1100110, 1100111, 1101000, 1101001, 1101010, 1101011,
 1101100, 1101101, 1101110, 1101111, 1110000, 1110001, 1110010, 1110011, 1110100,
 1110101, 1110110, 1110111, 1111000, 1111001, 1111010, 1111011, 1111100, 1111101,
 1111110, 1111111}
```

Out[ ]=
```
128
```

In[ ]:=
```
(* -- Esto es como si fuera 8 Hz --- 3 wavebits*)
(*-- Duración --- *)
stepTime = 0.0005;
stepFreq = 1 / stepTime;
(*Number of points*)
nn = 10 000;
(*Sample rate*)
sr = 550 * stepFreq;
(*Time increment*)
dt = 1 / sr;
df = sr / nn;
binary = Table[IntegerString[n, 2, nwavesbit], {n, 0, (2^nwavesbit - 1)}];
```

Encoding: 1ro lo dividimos

```
In[ ]:= myString = "Hello World!";
binaryStringS = StringSplit[myString, ""]
binaryStringMap = Table[RandomChoice[binary], {i, 1, Length[binaryStringS]}]
binaryString = Table[ToExpression[StringSplit[binaryStringMap[[i]], ""]],
  {i, 1, Length[binaryStringMap]}]
(*---*)
(* La frecuencias --*)
SizeString = Length[binaryString];
tinterval = N[sr / 2 / SizeString];
FreqIn = Table[2 π * RandomReal[{i * stepFreq, (i + 100) * stepFreq}], {i, 1, nwavesbit}]
```

```
Out[ ]= {H, e, l, l, o,  , W, o, r, l, d, !}

Out[ ]= {0111001, 0100000, 1000011, 1000010, 0110110, 1100001, 1010110, 1101011, 0011100,
  0101010, 0101100, 0011110}

Out[ ]= {{0, 1, 1, 1, 0, 0, 1}, {0, 1, 0, 0, 0, 0, 0}, {1, 0, 0, 0, 0, 1, 1}, {1, 0, 0, 0, 0, 1, 0},
  {0, 1, 1, 0, 1, 1, 0}, {1, 1, 0, 0, 0, 0, 1}, {1, 0, 1, 0, 1, 1, 0}, {1, 1, 0, 1, 0, 1, 1},
  {0, 0, 1, 1, 1, 0, 0}, {0, 1, 0, 1, 0, 1, 0}, {0, 1, 0, 1, 1, 0, 0}, {0, 0, 1, 1, 1, 1, 0}}

Out[ ]= {337 563., 301 570., 1.23139 × 10^6, 1.2026 × 10^6, 68 716.4, 738 566., 1.06924 × 10^6}
```

```
In[ ]:= myDir = NotebookDirectory[]; FreqIn = Import[myDir <> "Freqs_Test1_v3.tex", "List"];
```

```
In[ ]:= (* Arreglos -- *)
SizeElem = SizeString
Array[Awaves8Avark, {SizeString, nwavesbit}];
Array[fwaves8Avark, {SizeString, nwavesbit}];
Array[waves8Avark, {SizeString, nwavesbit}];
Array[Totalwaves8Avark, SizeString];
Array[samples1sec8Avark, SizeString];
Array[Twavesfft8Avark, SizeString];
(* Para los elementos finales de la matriz *)
Array[Totalwaves8Avark2, SizeElem];
Array[samples1sec8Avark2, SizeElem];
Array[Twavesfft8Avark2, SizeElem];
(* Para los elementos finales finales de la matriz *)
Array[Totalwaves8Avark3, 1];
Array[samples1sec8Avark3, 1];
Array[Twavesfft8Avark3, 1];
```

```
Out[ ]= 12
```

```
In[ ]:= tinterval = N[sr / 2 / SizeString];
Do[
 Do[
   Awaves8Avark[i, j] = binaryString[[i]][[j]];
   fwaves8Avark[i, j] = ToExpression[FreqIn[[j]] * Awaves8Avark[i, j];
   (*Print[binaryString[[i]][[j]]," : ",fwaves8Avark[i,j]];*)
   (* Asi todo el mundo va a ser diferente !! --*)
   waves8Avark[i, j] = If[Awaves8Avark[i, j] == 0, 0, Cos[fwaves8Avark[i, j] * t]];
   (*waves8Avark[i,j]=FourierSeries[t/2,t,2];*)
   , {j, 1, nwavesbit}];(*Print["-----"];*), {i, 1, SizeString}]
```

In[ ]:=
```
Do[
 (*--- Total ---*)
 Totalwaves8Avark[i] = Sum[waves8Avark[i, n], {n, 1, nwavesbit}];
 samples1sec8Avark[i] =
  Table[N[{t, Totalwaves8Avark[i]}], {t, (i - 1) * stepTime, i * stepTime, dt}];
 Twavesfft8Avark[i] = Fourier[samples1sec8Avark[i][[All, 2]]];
 , {i, 1, SizeString}]
```

Para ver cuando es más tiempo:

In[ ]:=
```
Do[
 (*--- Total ---*)
 samples1sec8Avark2[i] =
   Table[N[{t, Totalwaves8Avark[i]}], {t, (i - 1), i, dt * 100}];
 , {i, 1, SizeString}]
```

La conformacion de Los 4 elementos:

In[ ]:=
```
Totalwaves8Avark[1](*0000000*)
Totalwaves8Avark[2](*001*)
Totalwaves8Avark[3]
Totalwaves8Avark[4]
Totalwaves8Avark[5]
Totalwaves8Avark[6]
```

Finalmente Concatenamos:

In[ ]:=
```
(*-- Aqui se concatenan --*)
Welem = 1
Do[
 Print[" desde ", Welem * (i - 1) + 1, " : hasta ", Welem * (i - 1) + Welem];
 (*--- Total ---*)
 Totalwaves8Avark3[i] = Join[Table[Totalwaves8Avark[mm], {mm, 1, SizeString}]];
 samples1sec8Avark3[i] = Table[N[{t, Totalwaves8Avark3[i]}] // Flatten,
    {t, (i - 1) * stepTime, i * stepTime, dt}] // Flatten;
 Twavesfft8Avark3[i] =
  Join[Table[Twavesfft8Avark[mm] // Flatten, {mm, 1, SizeString}]] // Flatten
 (*Fourier[samples1sec8Avark3[i]];*)
 , {i, 1, 1}]
```

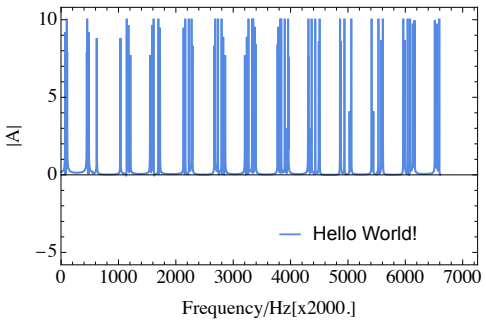
Out[ ]= 1

```
 desde 1 : hasta 1
```

In[ ]:=
```
fsz = 16;
imgsz = {400, 400}
ymin = -250;
ymax = 2;
xmin = -2;
xmax = sr * stepTime * SizeString * 1.1;(*220000*)
(*tambien hay información en 11000 *)
yminHz = -5;
ymaxHz = 10;
k = 1; (*- a -*)
m = 2;(*- b -*)
ptTotalIndi8k2 =
 Column[{ListLinePlot[Abs[(Twavesfft8Avark3[k])],
    Frame → True,
    FrameStyle → Directive[FontFamily → "Times"],
    LabelStyle → Directive[Black, fsz],
    PlotStyle → {{Thickness@0.005, Blue@Darker}},
    FrameLabel → {"Frequency/Hz" <> "[x" <> ToString[stepFreq] <> "]", "|A|"},
    PlotLegends → Placed[{myString}, {0.69, 0.12}],
    PlotRangePadding → {0.2, .8},
    PlotRange → {{xmin, xmax}, {yminHz, ymaxHz}},
    ImageSize → imgsz]}]
```

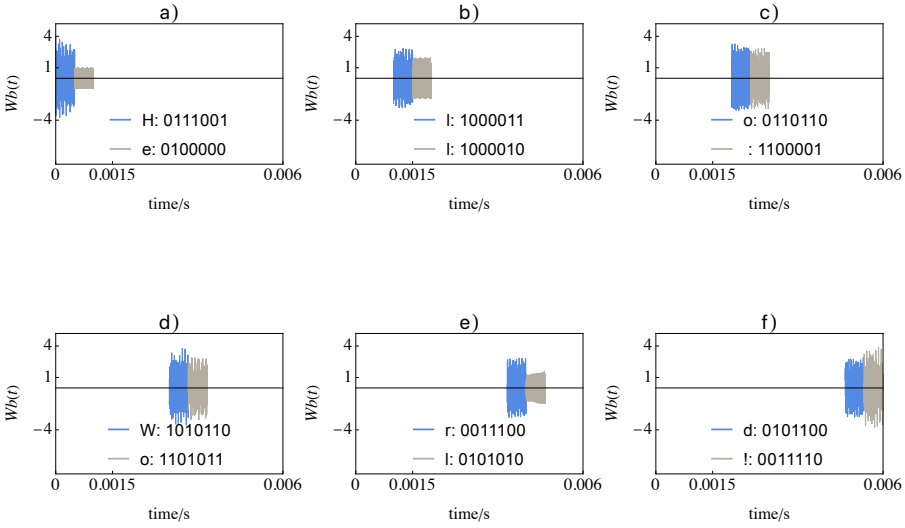
Out[ ]= {400, 400}

Out[ ]=



In[ ]:=
```
fsz = 14;
imgsz = {250, 250}
ymin = -8.2;
ymax = 5.2;
letters = {"a)", "", "b)", "", "c)", "", "d)", "", "e)", "", "f)"};
ptTotal1 = Row[Table[
    ListLinePlot[{samples1sec8Avark[m], samples1sec8Avark[m + 1]},
     Frame → True,
     FrameStyle → Directive[FontFamily → "Times"],
     LabelStyle → Directive[Black, fsz],
     PlotStyle → {{Thickness@0.005, Blue@Darker}},
     PlotLabel → letters[[m]],
     PlotLegends → Placed[{
        binaryStringS[[m]] <> ": " <> binaryStringMap[[m]],
        binaryStringS[[m + 1]] <> ": " <> binaryStringMap[[m + 1]]
       },
       {0.5, 0.2}],
     FrameLabel → {"time/s", "Wb (t)"},
     PlotRange → {{0, SizeString * stepTime}, {ymin, ymax}},
     FrameTicks →
      {{{-4, 4, 1}, None}, {{0, stepTime * 3, stepTime * SizeString}, None}},
     ImageSize → imgsz], {m, 1, 5, 2}]];
ptTotal2 = Row[Table[
    ListLinePlot[{samples1sec8Avark[m], samples1sec8Avark[m + 1]},
     Frame → True,
     FrameStyle → Directive[FontFamily → "Times"],
     LabelStyle → Directive[Black, fsz],
     PlotStyle → {{Thickness@0.005, Blue@Darker}},
     PlotLabel → letters[[m]],
     PlotLegends → Placed[{
        binaryStringS[[m]] <> ": " <> binaryStringMap[[m]],
        binaryStringS[[m + 1]] <> ": " <> binaryStringMap[[m + 1]]
       },
       {0.5, 0.2}],
     FrameLabel → {"time/s", "Wb (t)"},
     PlotRange → {{0, SizeString * stepTime}, {ymin, ymax}},
     FrameTicks →
      {{{-4, 4, 1}, None}, {{0, stepTime * 3, stepTime * SizeString}, None}},
     ImageSize → imgsz], {m, 7, 11, 2}]];
ptTotal = Grid[{{ptTotal1}, {ptTotal2}}]
```

Out[ ]= {250, 250}



Out[ ]=

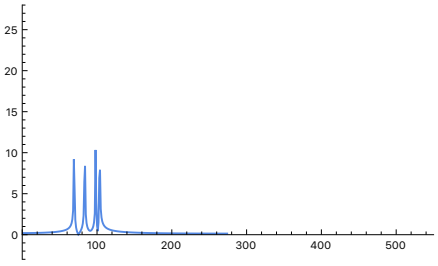
In[ ]:=
```
myDir = NotebookDirectory[];
Export[myDir <> "/Waves_8bits_HelloWorld_v7.png", ptTotal];
```

Decoding?

In[ ]:=
```
itest = 1;
npuntos = sr;
data = Table[{Range[(itest - 1) * sr * stepTime, itest * sr * stepTime][[j]],
    Abs[(Twavesfft8Avark[itest])][[j]]}, {j, 1, sr * stepTime / 2}];
```

In[ ]:=
```
ListLinePlot[data,
 PlotRange → {{(itest - 1) * sr * stepTime, itest * sr * stepTime}, {-3, 28}}]
```

Out[ ]=



In[ ]:=
```
(*----*)
binaryStringS[[itest]];
binaryStringMap[[itest]];
Totalwaves8Avark[itest];
FreqIn
peaks = FindPeaks[data[[All, 2]], 1, 1, 5]
```

Out[ ]=
```
{513 007., 870 613., 1.0482121082694172*^6, 1.2331338086689976*^6, 264 985., 869 858.,
 1.297988877870819*^6}
```

Out[ ]=
```
{{70, 9.19945}, {85, 8.38921}, {99, 10.3355}, {105, 7.91176}}
```

In[ ]:=
```
(*----*)
binaryStringS[[itest]]
Print["Mapa"];
binaryStringMap[[itest]]
decod1 =
 Table[If[Abs[2 π * N[peaks[[k, 1]]] * stepFreq - fwaves8Avark[itest, i]] < 15 * stepFreq
    , 1, 0], {k, 1, Length[peaks]}, {i, 1, nwavesbit}]
Print["Decodificado"];
Sum[decod1[[i]], {i, 1, Length[decod1]}]
```

Out[ ]= H

Mapa

Out[ ]= 0111001

Out[ ]= {{0, 1, 0, 0, 0, 0, 0}, {0, 0, 1, 0, 0, 0, 0}, {0, 0, 0, 1, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 1}}

Decodificado

Out[ ]= {0, 1, 1, 1, 0, 0, 1}

Hacer un diagrama cool de esta metodologia.

In[ ]:=
```
itest = 9;
Totalwaves8Avark[itest]
npuntos = sr;
rango = Range[(itest - 1) * sr * stepTime, itest * sr * stepTime];
data =
  Table[{rango[[j]], Abs[(Twavesfft8Avark[itest])][[j]]}, {j, 1, sr * stepTime / 2}];
(*----*)
binaryString[[itest]]
binaryStringS[[itest]]
binaryStringMap[[itest]]
Totalwaves8Avark[itest];
FreqIn
peaks = FindPeaks[data[[All, 2]], 1, 1, 5];
Table[N[2 π * peaks[[k, 1]] * stepFreq, {k, 1, Length[peaks]}]
(*----*)
decod1 = Table[
   If[Abs[2 π * N[peaks[[k, 1]] * stepFreq - fwaves8Avark[itest, i]] < 15 * stepFreq, 1, 0],
   {k, 1, Length[peaks]}, {i, 1, nwavesbit}];
SumDecod = Sum[decod1[[i]], {i, 1, Length[decod1]}]
SumDecod = Table[If[SumDecod[[i]] > 1, 1, SumDecod[[i]]], {i, 1, Length[SumDecod]}];
(*----*)
DecodFinal = If[SumDecod == binaryString[[itest]], binaryStringS[[itest]], "Unknown!"];
(*----*)
ListLinePlot[
 data,
 PlotStyle → {{Thickness@0.003, Blue@Darker}}, PlotLegends → Placed[{DecodFinal},
   {0.82, 0.95}],
 ImageSize → Small,
 (*PlotRange→
  {{(itest-1)*sr,(itest-1)*sr+0.05*Abs[(itest-1)*sr-itest*sr]},{-3,48}},*)
 PlotRange → {{rango[[1]] * 0.98,
    (peaks[[Length[peaks]]][[1]] + (itest - 1) * sr * stepTime - 1) + 100}, {-3, 25}},
 Epilog → Table[{Text[Style["", 10],
     {peaks[[l]][[1]] + (itest - 1) * sr * stepTime - 1,
      peaks[[l]][[2]] * 1.18}],
    Red, PointSize[Medium],
    Point@{peaks[[l]][[1]] + (itest - 1) * sr * stepTime - 1,
      peaks[[l]][[2]]}}, {l, 1, Length[peaks]}]
]
```

Out[ ]= $\text{Cos}[264\,985.\,t] + \text{Cos}\left[1.04821 \times 10^6\,t\right] + \text{Cos}\left[1.23313 \times 10^6\,t\right]$

Out[ ]= {0, 0, 1, 1, 1, 0, 0}

Out[ ]= r

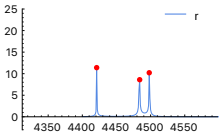
Out[ ]= 0011100

Out[ ]= {513 007., 870 613., 1.0482121082694172*^6, 1.2331338086689976*^6, 264 985., 869 858.,
 1.297988877870819*^6}

Out[ ]= $\left\{276\,460.,\ 1.06814 \times 10^6,\ 1.24407 \times 10^6\right\}$

Out[ ]= {0, 0, 1, 1, 1, 0, 0}

Out[ ] =

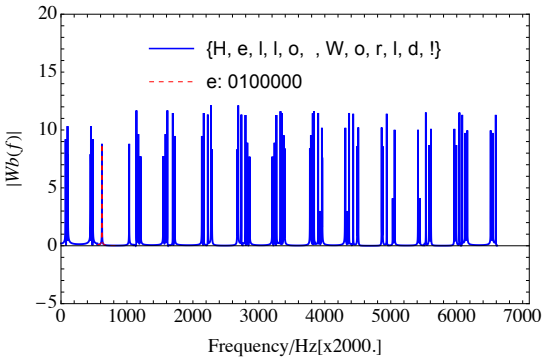


Conclusion: El cambio de amplitud en las ondas afecta el grosor de los picos de frecuencia.

Entonces la pregunta es: como es o queda

In[ ]:=
```
fsz = 16;
imgsz = {450, 450}
ymin = -4;
ymax = 4;
xmin = -500;
xmax = sr * SizeString * stepTime + 500; (*tambien hay información en 11000 *)
yminHz = -5;
ymaxHz = 20;
k = 1; (*- a -*)
m = 2;(*- 1, no tiene solucion  -- b -*)
ptHelloWHv1 = Show[{ListLinePlot[{
      Abs[(Twavesfft8Avark3[k])],
      Table[{Range[(m - 1) * sr * stepTime, m * sr * stepTime][[j]] + m,
        Abs[(Twavesfft8Avark[m])][[j]]}, {j, 1, sr * stepTime / 2}]
    },
    Frame → True,
    FrameStyle → Directive[FontFamily → "Times"],
    LabelStyle → Directive[Black, fsz],
    PlotStyle → {
      {Thickness@0.004, Blue},
      {Thickness@0.002, Red, Dashed}},
    FrameLabel → {"Frequency/Hz" <> "[x" <> ToString[stepFreq] <> "]", "|Wb(f)|"},
    PlotLegends → Placed[
      {binaryStringS, binaryStringS[[m]] <> ": " <> binaryStringMap[[m]]}, {0.5, 0.82}],
    PlotRange → {{0, xmax}, {yminHz, ymaxHz}},
    ImageSize → imgsz]}, Padding → 0]
```

Out[ ]= {450, 450}

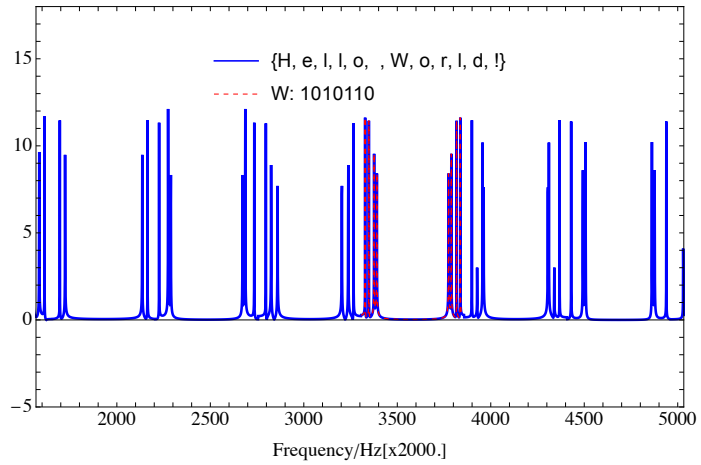
Out[ ]=



```
myDir = NotebookDirectory[];
Export[myDir <> "/Waves_8bits_Hello_v7.pdf", ptHelloWHv1];
```

In[ ]:=
```
fsz = 16;
imgsz = {600, 600}
ymin = -4;
ymax = 4;
xmin = -500;
xmax = sr * SizeString * stepTime + 500;
(*tambien hay información en 11000 *)
yminHz = -5;
ymaxHz = 18;
k = 1; (*- a -*)
m = 7;(*- 1, no tiene solucion  -- b -*)
ptTotalIndi8k2 =
 Column[{ListLinePlot[{
     Abs[(Twavesfft8Avark3[k])],
     Table[{Range[(m - 1) * sr * stepTime, m * sr * stepTime][[j]] + m,
       Abs[(Twavesfft8Avark[m])][[j]]}, {j, 1, sr * stepTime}]
    },
    Frame → True,
    FrameStyle → Directive[FontFamily → "Times"],
    LabelStyle → Directive[Black, fsz],
    PlotStyle → {
      {Thickness@0.004, Blue},
      {Thickness@0.002, Red, Dashed}},
    FrameLabel → {"Frequency/Hz" <> "[x" <> ToString[stepFreq] <> "]", "|A|"},
    PlotLegends → Placed[
      {binaryStringS, binaryStringS[[m]] <> ": " <> binaryStringMap[[m]]}, {0.5, 0.82}],
    PlotRange → {{(m - 1) * sr * stepTime -
        6.3 * Abs[(m - 1) * sr * stepTime - m * sr * stepTime] / 2, (m - 1) * sr * stepTime +
        6.3 * Abs[(m - 1) * sr * stepTime - m * sr * stepTime] / 2}, {yminHz, ymaxHz}},
    ImageSize → imgsz]}]
```

Out[ ]= {600, 600}

Out[ ]=

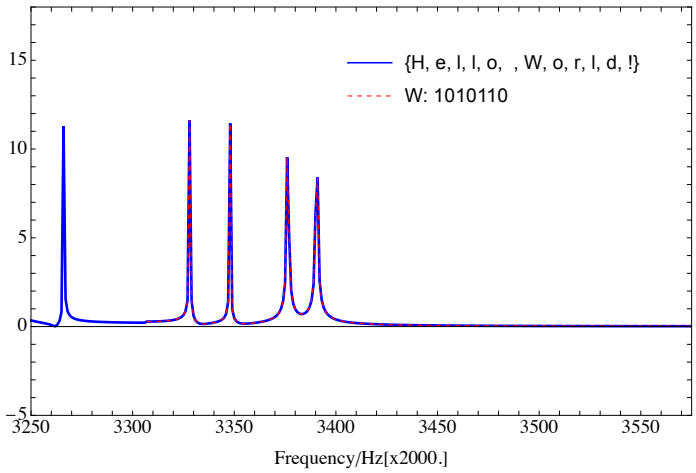


In[ ]:=

```
fsz = 16;
imgsz = {600, 600}
ymin = -4;
ymax = 4;
xmin = -500;
xmax = sr * SizeString * stepTime + 500; (*tambien hay información en 11000 *)
yminHz = -5;
ymaxHz = 18;
k = 1; (*- a -*)
m = 7;(*- 1, no tiene solucion  -- b -*)
ptOneletterandHellov1 =
 Column[{ListLinePlot[{
     Abs[(Twavesfft8Avark3[k])],
     Table[{Range[(m - 1) * sr * stepTime, m * sr * stepTime][[j]] + m,
       Abs[(Twavesfft8Avark[m])][[j]]}, {j, 1, sr * stepTime}]
    },
    Frame → True,
    FrameStyle → Directive[FontFamily → "Times"],
    LabelStyle → Directive[Black, fsz],
    PlotStyle → {
      {Thickness@0.004, Blue},
      {Thickness@0.002, Red, Dashed}},
    FrameLabel → {"Frequency/Hz" <> "[x" <> ToString[stepFreq] <> "]", "|Wb(f)|"},
    PlotLegends → Placed[
      {binaryStringS, binaryStringS[[m]] <> ": " <> binaryStringMap[[m]]}, {0.7, 0.82}],
    PlotRange → {{(m - 1) * sr * stepTime - 50, (m - 1) * sr * stepTime +
        0.5 * Abs[(m - 1) * sr * stepTime - m * sr * stepTime]}, {yminHz, ymaxHz}},
    ImageSize → imgsz]}]
```

Out[ ]= {600, 600}

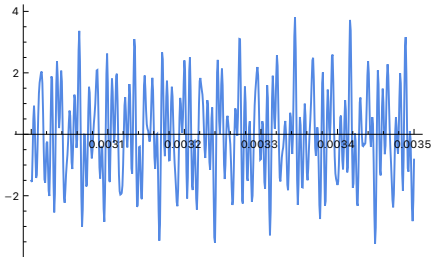
Out[ ]=




```
myDir = NotebookDirectory[];
Export[myDir <> "/Waves_OneLetter_Hello_v7.pdf", ptOneletterandHellov1];
```

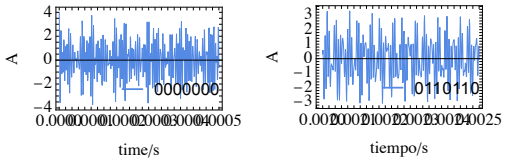
In[ ]:= `ListLinePlot[samples1sec8Avark[m]]`

Out[ ]=

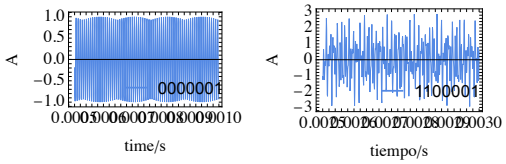


In[ ]:=
```
fsz = 14;
imgsz = {200, 200}
ymin = -5;
ymax = 5;
ptTotal = Style[Row[{{Column[Table[ListLinePlot[samples1sec8Avark[m],
         Frame → True,
         FrameStyle → Directive[FontFamily → "Times"],
         LabelStyle → Directive[Black, fsz],
         PlotStyle → {{Thickness@0.005, Blue@Darker}},
         FrameLabel → {"time/s", "A"},
         (*PlotLegends→{"from binary = "<>binary[[m]]},*)
         PlotLegends → Placed[{"" <> binary[[m]]}, {0.69, 0.2}],
         (*PlotRange→
          {{(m-1)*sr*dt*stepTime,(m-1)*sr*dt*stepTime+0.5},{ymin,ymax}},*)
         ImageSize → imgsz], {m, 1, 4}]]},
    (*-- Otra mitad --*)
    Column[Table[ListLinePlot[samples1sec8Avark[m],
       Frame → True,
       FrameStyle → Directive[FontFamily → "Times"],
       LabelStyle → Directive[Black, fsz],
       PlotStyle → {{Thickness@0.005, Blue@Darker}},
       FrameLabel → {"tiempo/s", "A"},
       PlotLegends → Placed[{"" <> binaryStringMap[[m]]}, {0.69, 0.2}],
       (*PlotRange→
        {{(m-1)*sr*dt*stepTime,(m-1)*sr*dt*stepTime+0.5},{ymin,ymax}},*)
       ImageSize → imgsz], {m, 5, 8}]]
   }]]
```

Out[ ]= {200, 200}

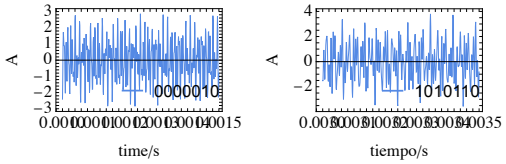

A
0000000
time/s

A
0110110
tiempo/s

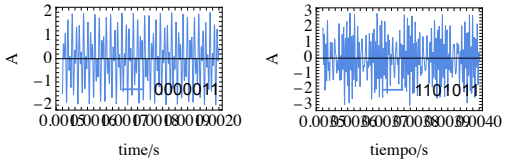

A
0000001
time/s

A
1100001
tiempo/s

Out[ ] =


A
0000010
time/s

A
1010110
tiempo/s


A
0000011
time/s

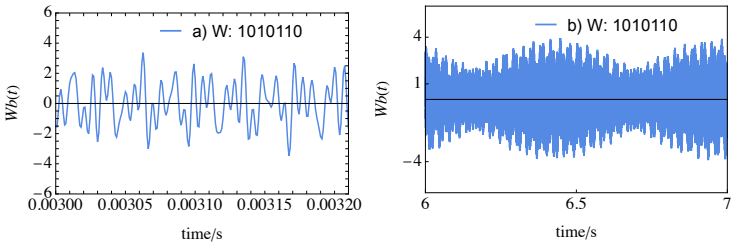
A
1101011
tiempo/s

Individuales:

In[ ]:=
```
fsz = 14;
imgsz = {300, 300};
imgsz2 = {800, 300}
ymin = -6;
ymax = 6;
mm = 7;
ptIndi2Rowa = Grid[{{ListLinePlot[samples1sec8Avark[mm],
      Frame → True,
      FrameStyle → Directive[FontFamily → "Times"],
      LabelStyle → Directive[Black, fsz],
      PlotStyle → {{Thickness@0.005, Blue@Darker}},
      FrameLabel → {"time/s", "Wb(t)"},
      PlotLegends → Placed[
        {"a) " <> "" <> binaryStringS[[mm]] <> ": " <> binaryStringMap[[mm]]}, {0.6, 0.9}],
      PlotRange → {{(mm - 1) * stepTime,
         (mm - 1) * stepTime + (mm - 1) * stepTime * 0.07}, {ymin, ymax}},
      (*FrameTicks→
       {{{-4,4,1},None},{{0,stepTime*4,stepTime*SizeString*0.8},None}},*)
      ImageSize → imgsz],
     ListLinePlot[samples1sec8Avark2[mm],
      Frame → True,
      FrameStyle → Directive[FontFamily → "Times"],
      LabelStyle → Directive[Black, fsz],
      PlotStyle → {{Thickness@0.005, Blue@Darker}},
      FrameLabel → {"time/s", "Wb(t)"},
      PlotLegends → Placed[
        {"b) " <> "" <> binaryStringS[[mm]] <> ": " <> binaryStringMap[[mm]]}, {0.6, 0.9}],
      PlotRange → {{6, 7}, {ymin, ymax}},
      FrameTicks → {{{-4, 4, 1}, None}, {{6, 6.5, 7}, None}},
      ImageSize → imgsz]}}]
```

Out[ ]= {800, 300}

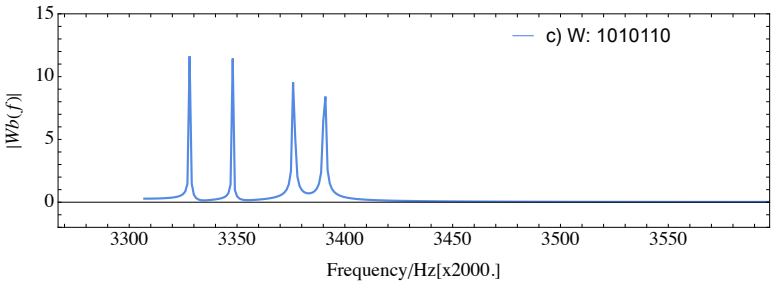
Out[ ]=



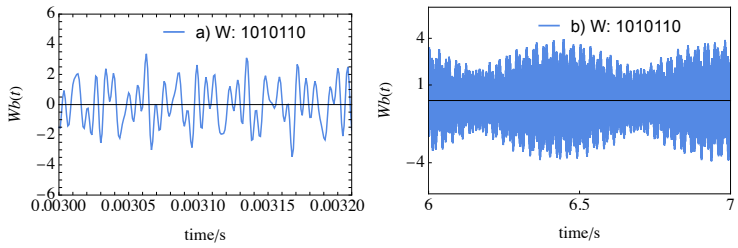
In[ ]:=
```
fsz = 16;
imgsz = {300, 300};
imgsz2 = {640, 250}
mm = 7;
ymin = -2;
ymax = 4;
xmin = 10 300;
xmax = 10 700; (*tambien hay información en 11000 *)
yminHz = -2;
ymaxHz = 15;

ptIndi2Rowb =
 ListLinePlot[Table[{Range[(mm - 1) * sr * stepTime, mm * sr * stepTime][[j]] + mm,
    Abs[(Twavesfft8Avark[mm])][[j]]}, {j, 1, sr * stepTime}],
  Frame → True,
  FrameStyle → Directive[FontFamily → "Times"],
  LabelStyle → Directive[Black, fsz],
  PlotStyle → {{Thickness@0.003, Blue@Darker}},
  FrameLabel → {"Frequency/Hz" <> "[x" <> ToString[stepFreq] <> "]", "|Wb(f)|"},
  (* -- *)
  PlotLegends → Placed[
    {"c) " <> "" <> binaryStringS[[mm]] <> ": " <> binaryStringMap[[mm]]}, {0.75, 0.9}],
  PlotRange → {{(mm - 1) * sr * stepTime * 0.99, (mm - 1) * sr * stepTime * 0.99 +
      0.6 * Abs[(mm - 1) * sr * stepTime - mm * sr * stepTime]}, {yminHz, ymaxHz}},
  AspectRatio → 0.3,
  ImageSize → imgsz2]
```

Out[ ]= {640, 250}

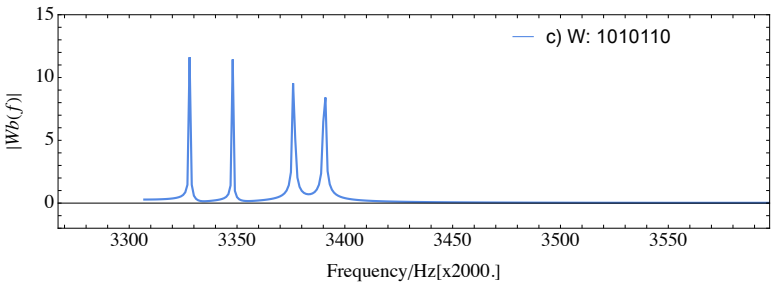
Out[ ]=



In[ ]:=
```
ptIndiTotaln7 = Grid[{{ptIndi2Rowa}, {ptIndi2Rowb}}]
```



Out[ ]=



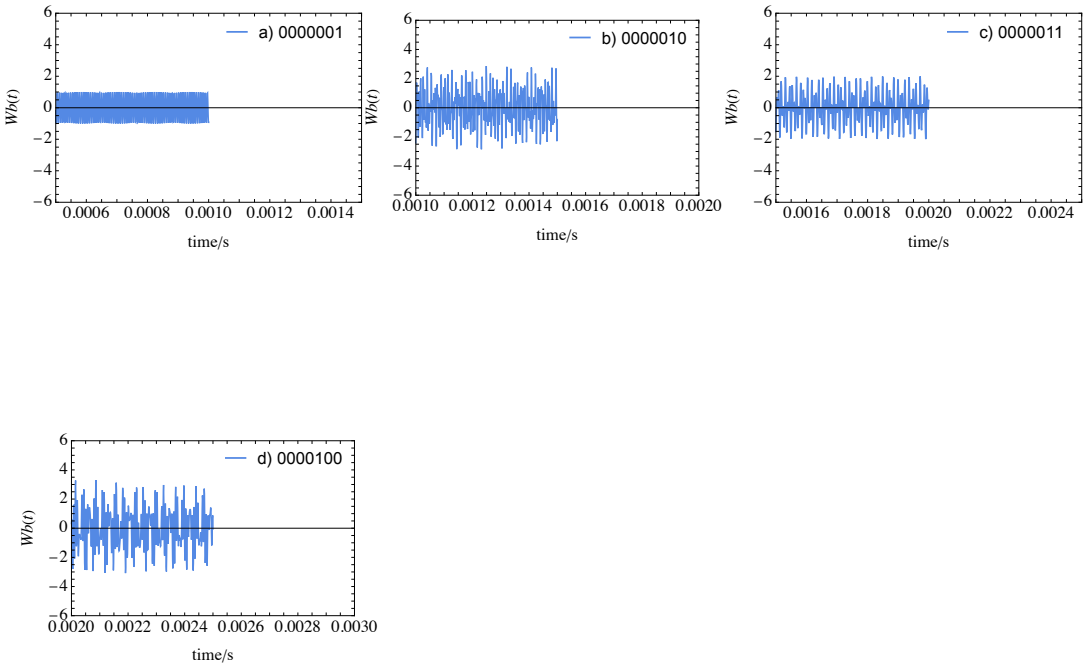
In[ ]:=
```
myDir = NotebookDirectory[];
Export[myDir <> "/Waves_128bits_Indi_variable_v7.png", ptIndiTotaln7];
```

In[ ]:=
```
fsz = 14;
imgsz = {300, 300};
imgsz2 = {800, 300}
ymin = -6;
ymax = 6;
mm = 4;
strings = {"a) ", "b) ", "c) ", "d) "}
pt4wavesRows = Row[Table[ListLinePlot[
    samples1sec8Avark[mm],
    Frame → True,
    FrameStyle → Directive[FontFamily → "Times"],
    LabelStyle → Directive[Black, fsz],
    PlotStyle → {{Thickness@0.005, Blue@Darker}},
    FrameLabel → {"time/s", "Wb(t)"},
    (*PlotLegends→{"from binary = "<>binary[[m]]},*)
    PlotLegends → Placed[{strings[[mm - 1]] <> binary[[mm]]}, {0.75, 0.9}],
    PlotRange →
     {{(mm - 1) * sr * dt * stepTime, (mm - 1) * sr * dt * stepTime + 0.001}, {ymin, ymax}},
    ImageSize → imgsz], {mm, 2, 5}]]
```

Out[ ]= {800, 300}

Out[ ]= {a) , b) , c) , d) }

Out[ ]=



In[ ]:=
```
myDir = NotebookDirectory[];
Export[myDir <> "/Waves_8bits_4waves_variable_v4.png", pt4wavesRows];
```

Decodificando:

In[ ]:=
```
Clear[ptDecod]
```

In[ ]:=
```
Array[ptDecod, 2]
```

Out[ ]=
```
{ptDecod[1], ptDecod[2]}
```

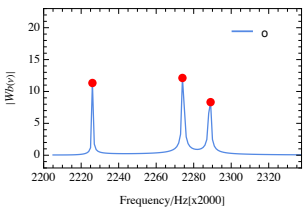
In[ ]:=
```
binaryStringS
```

Out[ ]=
```
{H, e, l, l, o,  , W, o, r, l, d, !}
```

In[ ]:=
```
fsz = 10;
imgsz = {250, 250}
yminHz = -2;
ymaxHz = 23;
letters = {"a)", "", "b)", "", "c)", "", "d)", "", "e)", "", "f)"};
m = 5;
data = Table[{Range[(m - 1) * sr * stepTime, m * sr * stepTime][[j]] + (m),
    Abs[(Twavesfft8Avark[m])][[j]]}, {j, 1, sr * stepTime / 2}];
peaks = FindPeaks[data[[All, 2]], 1, 1, 5];
p5 = ListLinePlot[{Table[{Range[((m) - 1) * sr * stepTime, (m) * sr * stepTime][[j]] + (m),
     Abs[(Twavesfft8Avark[(m)])][[j]]}, {j, 1, sr * stepTime}]},
  (*--*)
  Epilog → Table[{Text[Style["", 10],
     {peaks[[l]][[1]] + ((m) - 1) * sr * stepTime + 1, peaks[[l]][[2]] * 1.18}], Red,
    PointSize[Large], Point@{peaks[[l]][[1]] + ((m) - 1) * sr * stepTime + m - 1,
      peaks[[l]][[2]]}}, {l, 1, Length[peaks]}],
  (*--*)
  Frame → True,
  FrameStyle → Directive[FontFamily → "Times"],
  LabelStyle → Directive[Black, fsz],
  PlotStyle → {{Thickness@0.005, Blue@Darker}},
  (*PlotLabel→letters[[m]],*)
  PlotLegends → Placed[{
     binaryStringS[[m]],
     binaryStringS[[m + 1]]
    },
    {0.8, 0.85}],
  FrameLabel → {"Frequency/Hz" <> "[x2000]", "|Wb (ν)|"},
  PlotRange → {{(m - 1) * sr * stepTime,
     (m - 1) * sr * stepTime + 0.5 * Abs[(m - 1) * sr * stepTime - m * sr * stepTime] / 2},
    {yminHz, ymaxHz}},
  ImageSize → imgsz]
```

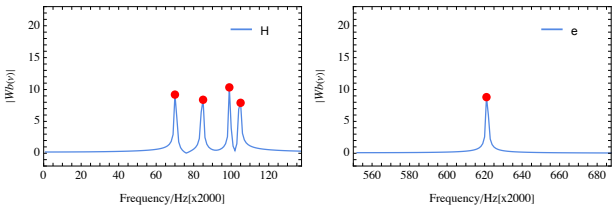
Out[ ]=
```
{250, 250}
```

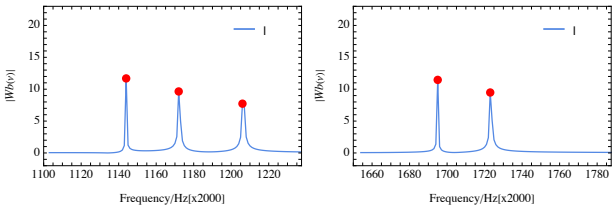
Out[ ]=

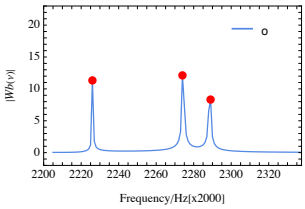


In[•]:=
```
ptDecodHellov4 = Grid[{{p1, p2}, {p3, p4}, {p5}}]
```

Out[•]=







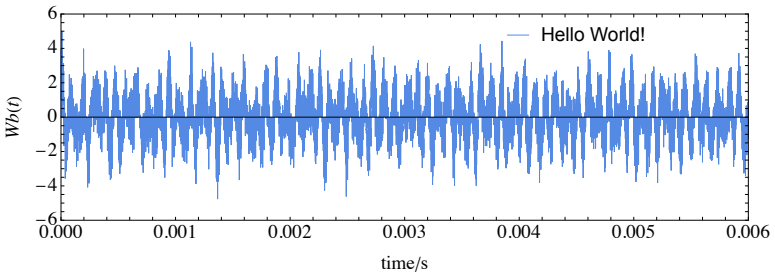
In[•]:=
```
myDir = NotebookDirectory[];
Export[myDir <> "/Decodifying_8bits_HelloW_v6_Paper.png", ptDecodHellov4];
```

La onda completa:

In[ ]:=
```
fsz = 16;
imgsz = {300, 300};
imgsz2 = {640, 250}
mm = 7;
ymin = -6;
ymax = 6;
xmin = 10 300;
xmax = 10 700; (*tambien hay información en 11000 *)
yminHz = -2;
ymaxHz = 32;

ptTotalWave2 =
 ListLinePlot[
  Table[{i * dt, samples1sec8Avark3[1][[i]]}, {i, 1, Length[samples1sec8Avark3[1]]}],
  Frame → True,
  FrameStyle → Directive[FontFamily → "Times"],
  LabelStyle → Directive[Black, fsz],
  PlotStyle → {{Thickness@0.001, Blue@Darker}},
  FrameLabel → {"time/s", "Wb (t)"},
  (* -- *)
  PlotLegends → Placed[{"Hello World!"}, {0.75, 0.9}],
  AspectRatio → 0.3,
  PlotRange → {{0, SizeString * stepTime}, {ymin, ymax}},
  ImageSize → imgsz2]
```

Out[ ]= {640, 250}

Out[ ]=



In[ ]:=
```
myDir = NotebookDirectory[];
Export[myDir <> "/Decodifying_Total_HelloW_v5.png", ptTotalWave2];
```