

```

public class FFTransform
{
    public static float[][] realDataForwardXform(float[] data,int start
        ,int windowSize,int bufferSize)
    {
        if(windowSize%2!=0)
        {
            System.out.println("Window size must be a power of 2!");
            return null;
        }
        int level=(int)(Math.log(windowSize)/Math.log(2)+.5f);
        float[][] fft=new float[2][windowSize];

        float exp,real,imag,t1,t2,t3,t4,f1real,f1imag,f2real,f2imag;
        int m,n;
        for(int j=level;j>=1;j--) // iterates over levels, starting at bottom
        {
            int size=(int)Math.pow(2,level-j+1);
            for(int i=0;i<windowSize;i+=size) // groupings
            {
                for(int k=0;k<size/2;k++) // within group
                {
                    exp=-2*k*(float)(Math.PI)/size;
                    real=(float)Math.cos(exp);
                    imag=(float)Math.sin(exp);
                }
            }
        }
    }
}

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m=i+size/2+k;

n=i+k;

if(j==level)
{
    t1=data[(map[level][m]+start)%bufferSize]*real;

    t2=0;

    t3=data[(map[level][m]+start)%bufferSize]*imag;

    t4=0;

    f1real=data[(map[level][n]+start)%bufferSize]+t1-t2;

    f1imag=0;

    f2real=data[(map[level][n]+start)%bufferSize]-t1+t2;

    f2imag=0;

}

else

{

    t1=fft[0][m]*real;

    t2=fft[1][m]*imag;

    t3=fft[0][m]*imag;

    t4=fft[1][m]*real;

    f1real=fft[0][n]+t1-t2;

    f1imag=fft[1][n]+t3+t4;

    f2real=fft[0][n]-t1+t2;

    f2imag=fft[1][n]-t3-t4;

}

fft[0][n]=f1real;

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    fft[1][n]=f1imag;
    fft[0][m]=f2real;
    fft[1][m]=f2imag;
}
}
}
return fft;
}

```

```

public static float[][] realDataForwardXform(float[] data,int start
        ,int windowSize,int bufferSize,float[] hannWindow)
{
    if(windowSize%2!=0)
    {
        System.out.println("Window size must be a power of 2!");
        return null;
    }
    int level=(int)(Math.log(windowSize)/Math.log(2)+.5f);
    float[][] fft=new float[2][windowSize];

    float exp,real,imag,t1,t2,t3,t4,f1real,f1imag,f2real,f2imag;
    int m,n;
    for(int j=level;j>=1;j--) // iterates over levels, starting at bottom
    {
        int size=(int)Math.pow(2,level-j+1);

```

```

for(int i=0;i<windowSize;i+=size) // groupings
{
    for(int k=0;k<size/2;k++) // within group
    {
        exp=-2*k*(float)(Math.PI)/size;
        real=(float)Math.cos(exp);
        imag=(float)Math.sin(exp);
        m=i+size/2+k;
        n=i+k;
        if(j==level)
        {
            t1=data[(map[level][m]+start)%bufferSize]
                *hannWindow[map[level][m]]*real;
            t2=0;
            t3=data[(map[level][m]+start)%bufferSize]
                *hannWindow[map[level][m]]*imag;
            t4=0;
            f1real=data[(map[level][n]+start)%bufferSize]
                *hannWindow[map[level][n]]+t1-t2;
            f1imag=0;
            f2real=data[(map[level][n]+start)%bufferSize]
                *hannWindow[map[level][n]]-t1+t2;
            f2imag=0;
        }
    }
}
else

```

```

{
    t1=fft[0][m]*real;
    t2=fft[1][m]*imag;
    t3=fft[0][m]*imag;
    t4=fft[1][m]*real;
    f1real=fft[0][n]+t1-t2;
    f1imag=fft[1][n]+t3+t4;
    f2real=fft[0][n]-t1+t2;
    f2imag=fft[1][n]-t3-t4;
}
fft[0][n]=f1real;
fft[1][n]=f1imag;
fft[0][m]=f2real;
fft[1][m]=f2imag;
}
}
}
return fft;
}

```

```

public static void realDataInverseXformOverlapAdd(float[][] fft,float[] data,int start
    ,int windowSize,int bufferSize)
{
    if(windowSize%2!=0)
    {

```

```

System.out.println("Window size must be a power of 2!");

return;
}

int level=(int)(Math.log(windowSize)/Math.log(2)+.5f);

float[][] ifft=new float[2][windowSize];

float exp,real,imag,f0,f1,t1,t2,t3,t4,f1real,f1imag,f2real,f2imag;

int m,n;

for(int j=level;j>=1;j--) // iterates over levels, starting at bottom
{
    int size=(int)Math.pow(2,level-j+1);

    for(int i=0;i<windowSize;i+=size) // groupings
    {
        for(int k=0;k<size/2;k++) // within group
        {
            exp=-2*k*(float)(Math.PI)/size;

            real=(float)Math.cos(exp);

            imag=(float)Math.sin(exp);

            m=i+size/2+k;

            n=i+k;

            if(j==level)
            {
                f0=fft[0][map[level][m]]/windowSize;

                f1=fft[1][map[level][m]]/windowSize;

                t1=f0*real;

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t2=-f1*imag;

t3=f0*imag;

t4=-f1*real;

f0=fft[0][map[level][n]]/windowSize;

f1=fft[1][map[level][n]]/windowSize;

f1real=f0+t1-t2;

f1imag=-f1+t3+t4;

f2real=f0-t1+t2;

f2imag=-f1-t3-t4;

}

else

{

t1=ifft[0][m]*real;

t2=ifft[1][m]*imag;

t3=ifft[0][m]*imag;

t4=ifft[1][m]*real;

f1real=ifft[0][n]+t1-t2;

f1imag=ifft[1][n]+t3+t4;

f2real=ifft[0][n]-t1+t2;

f2imag=ifft[1][n]-t3-t4;

}

ifft[0][n]=f1real;

ifft[1][n]=f1imag;

ifft[0][m]=f2real;

ifft[1][m]=f2imag;

```

```

    }
}
}
for(int i=0;i<windowSize;i++)
{
    data[(i+start)%bufferSize]=ifft[0][i];
}
}

public static void realDataInverseXformOverlapAdd(float[][] fft,float[] data,int start
    ,int windowSize,int bufferSize,float[] hannWindow,float beta)
{
    if(windowSize%2!=0)
    {
        System.out.println("Window size must be a power of 2!");
        return;
    }
    int level=(int)(Math.log(windowSize)/Math.log(2)+.5f);
    float[][] ifft=new float[2][windowSize];

    float exp,real,imag,f0,f1,t1,t2,t3,t4,f1real,f1imag,f2real,f2imag;
    int m,n;
    for(int j=level;j>=1;j--) // iterates over levels, starting at bottom
    {
        int size=(int)Math.pow(2,level-j+1);

```



```

for(int i=0;i<windowSize;i+=size) // groupings
{
    for(int k=0;k<size/2;k++) // within group
    {
        exp=-2*k*(float)(Math.PI)/size;
        real=(float)Math.cos(exp);
        imag=(float)Math.sin(exp);
        m=i+size/2+k;
        n=i+k;
        if(j==level)
        {
            f0=fft[0][map[level][m]]/windowSize;
            f1=fft[1][map[level][m]]/windowSize;
            t1=f0*real;
            t2=-f1*imag;
            t3=f0*imag;
            t4=-f1*real;
            f0=fft[0][map[level][n]]/windowSize;
            f1=fft[1][map[level][n]]/windowSize;
            f1real=f0+t1-t2;
            f1imag=-f1+t3+t4;
            f2real=f0-t1+t2;
            f2imag=-f1-t3-t4;
        }
        else

```

```

{
    t1=ifft[0][m]*real;
    t2=ifft[1][m]*imag;
    t3=ifft[0][m]*imag;
    t4=ifft[1][m]*real;
    f1real=ifft[0][n]+t1-t2;
    f1imag=ifft[1][n]+t3+t4;
    f2real=ifft[0][n]-t1+t2;
    f2imag=ifft[1][n]-t3-t4;
}
ifft[0][n]=f1real;
ifft[1][n]=f1imag;
ifft[0][m]=f2real;
ifft[1][m]=f2imag;
}
}
}
int i1,i2;
float y1,y2;
int newSize=(int)(windowSize/beta+.5f);
for(int i=1;i<newSize-1;i++)
{
    i1=(int)(i*beta);
    i2=i1+1;
    if(i1>windowSize-2) break;
}

```

```
y1=ifft[0][i1]*hannWindow[i1];
y2=ifft[0][i2]*hannWindow[i2];
data[(i+start)%bufferSize]+=((i*beta-i1)*(y2-y1)+y1);
}
}
```

```
public static int[][] map={
    {0},
    {0,1},
    {0,2,1,3},
    {0,4,2,6,1,5,3,7},
    {0,8,4,12,2,10,6,14,1,9,5,13,3,11,7,15},
    {0,16,8,24,4,20,12,28,2,18,10,26,6,
    22,14,30,1,17,9,25,5,21,13,29,3,
    19,11,27,7,23,15,31},
    {0,32,16,48,8,40,24,56,4,36,20,52,12,
    44,28,60,2,34,18,50,10,42,26,58,6,
    38,22,54,14,46,30,62,1,33,17,49,9,
    41,25,57,5,37,21,53,13,45,29,61,3,
    35,19,51,11,43,27,59,7,39,23,55,15,
    47,31,63},
    {0,64,32,96,16,80,48,112,8,72,40,104,24,
    88,56,120,4,68,36,100,20,84,52,116,12,
    76,44,108,28,92,60,124,2,66,34,98,18,
    82,50,114,10,74,42,106,26,90,58,122,6,
```

70,38,102,22,86,54,118,14,78,46,110,30,  
94,62,126,1,65,33,97,17,81,49,113,9,  
73,41,105,25,89,57,121,5,69,37,101,21,  
85,53,117,13,77,45,109,29,93,61,125,3,  
67,35,99,19,83,51,115,11,75,43,107,27,  
91,59,123,7,71,39,103,23,87,55,119,15,  
79,47,111,31,95,63,127},  
{0,128,64,192,32,160,96,224,16,144,80,208,48,  
176,112,240,8,136,72,200,40,168,104,232,24,  
152,88,216,56,184,120,248,4,132,68,196,36,  
164,100,228,20,148,84,212,52,180,116,244,12,  
140,76,204,44,172,108,236,28,156,92,220,60,  
188,124,252,2,130,66,194,34,162,98,226,18,  
146,82,210,50,178,114,242,10,138,74,202,42,  
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1102,590,1614,334,1358,846,1870,206,1230,718,1742,462,  
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