Aplicações de sinais

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DEEC - 2021

Começando:

Apresentação para esta aula: (20 Abr)

Elmarlon Correia Pontes 38166

- Para uma mesma duração temporal, ordene justificadamente da maior para a menor energia na primeira banda lateral (sidelobe) as seguintes janelas:

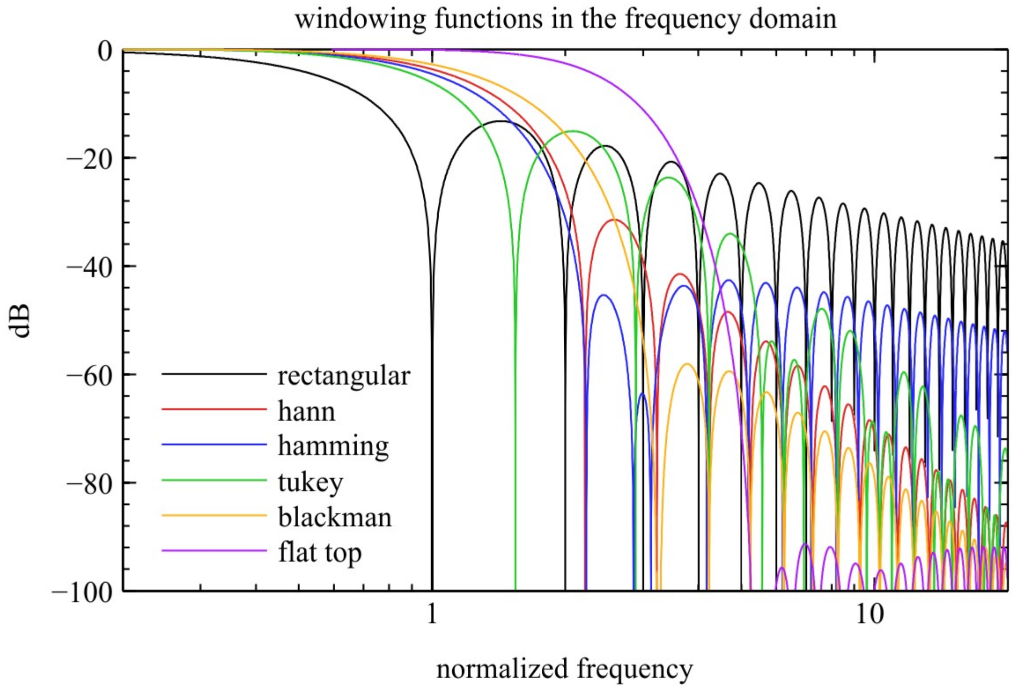
  a) Gaussiana

  b) Rectangular

  c) Triangular

  d) Hamming

  e) Hanning



Scalloping loss   Perda espectral

D. Scalloping Loss

An important consideration related to minimum detectable signal is called scalloping loss or picket-fence effect.

We also define the scalloping loss as the ratio of coherent gain for a tone located half a bin from a DFT sample point to the coherent gain for a tone located at a DFT sample point, as indicated in

$$\text{Scalloping Loss} = \frac{\left|\sum_n w(nT)\exp\left(-j\frac{\pi}{N}n\right)\right|}{\sum_n w(nT)} = \frac{\left|W\left(\frac{1}{2}\frac{\omega s}{N}\right)\right|}{W(0)}. \tag{20b}$$

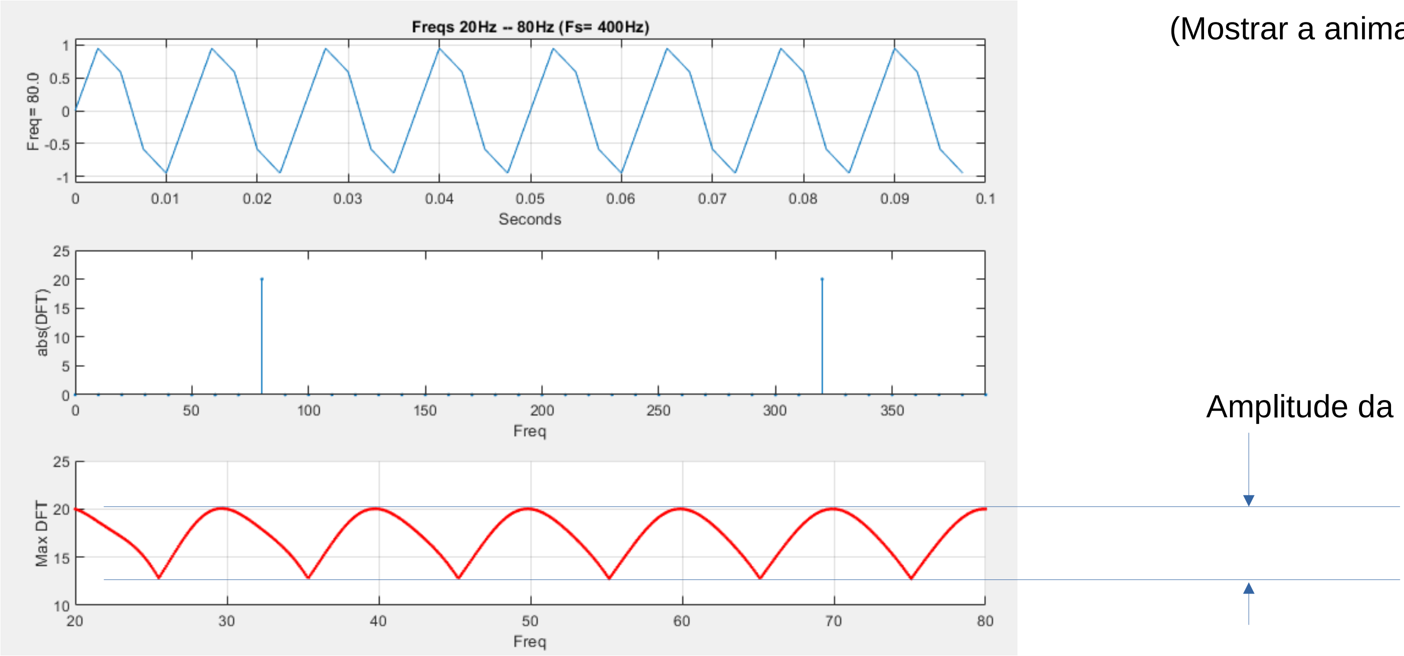
Scalloping loss represents the maximum reduction in PG due to signal frequency. This loss has been computed for the windows of this report and has been included in Table I.

Harris - 1978

Scallop ==   recorte,
prega,
dendilhado

Considerações sobre Janelas … 6

Scalloping loss Perda espectral



(Mostrar a animação no Matlab)

Amplitude da perda espectral

Gráfico do valor máximo do abs(DFT) de 40 pontos para uma sinusóide com frequência de 20 Hz a 80 Hz.
A frequência de amostragem é de 400 Hz.

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Scalloping loss　　Perda espectral

```
clear
close all
clc
%
% Code to plot the maximum value of the
% DFT of 40 points taken on a pure sine wave with
% frequencies between 20 Hz and 80 Hz.
% The sampling frequency is 400 Hz.
% rtrato.a.fct.unl.pt - 2021

qFs= 400;
qTs= 1/qFs;

qNN= 40;
bnn=0:(qNN-1);
ktt= qTs*bnn';

qZeroPadExp= 1;
kFf= (qFs*(0:(qZeroPadExp*qNN-1))')./(qZeroPadExp*qNN);

for ff=20:0.1:80
    kSs= sin(2*pi*ff*ktt);
    kSsf= abs(fft(kSs, qNN*qZeroPadExp));

    kSsfH= kSsf(1:(qNN));
    kFfH= kFf(1:(qNN));
    qMax= max(kSsfH);

    % Signal
    subplot(3,1,1);
    plot(ktt,kSs); grid on;
    title('Freqs 20Hz -- 80Hz (Fs= 400Hz)')
    ylabel(sprintf('Freq= %3.1f', ff));
    axis([ 0 0.1 -1.1 1.1]);
    xlabel('Seconds')

    % abs(DFT) - linear units
    subplot(3,1,2);
    stem(kFfH, kSsfH,'.');
    axis([0 max(kFfH) 0 25]);
    xlabel('Freq');
    ylabel('abs(DFT)')

    % Scalloping loss - Perda espectral
    subplot(3,1,3)
    hold on;
    plot(ff, qMax, '.r');
    hold off;
    axis([20 80 10 25]);
    xlabel('Freq');
    ylabel('Max DFT');
    grid on;

    pause(0.01);
end
```

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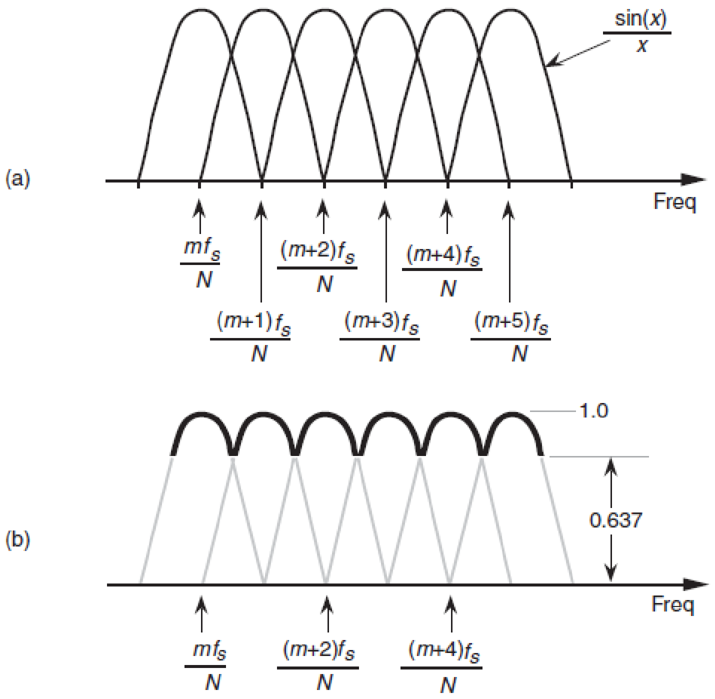
Scalloping loss — Perda espectral



DFT bin magnitude response curves: (a) individual $\sin(x)/x$ responses for each DFT bin; (b) equivalent overall DFT magnitude response.

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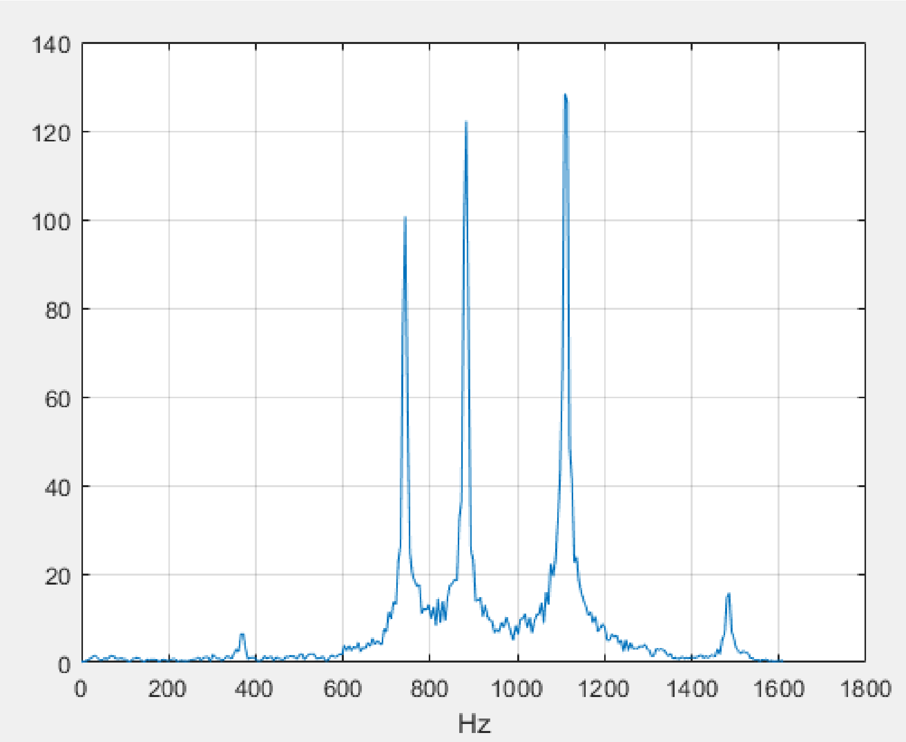
Reparem que a duração da janela
é muito menor que a duração da música

```
close all
clear
clc
%
load('DMonky.mat')
kDm= kDMonky(21100:25500);

NN= 8192;
bff= (0:(NN-1))*(44100/NN);
kDmfa= abs(fft(kDm,NN));

plot(bff(1:300), kDmfa(1:300)); grid on; xlabel('Hz')
```



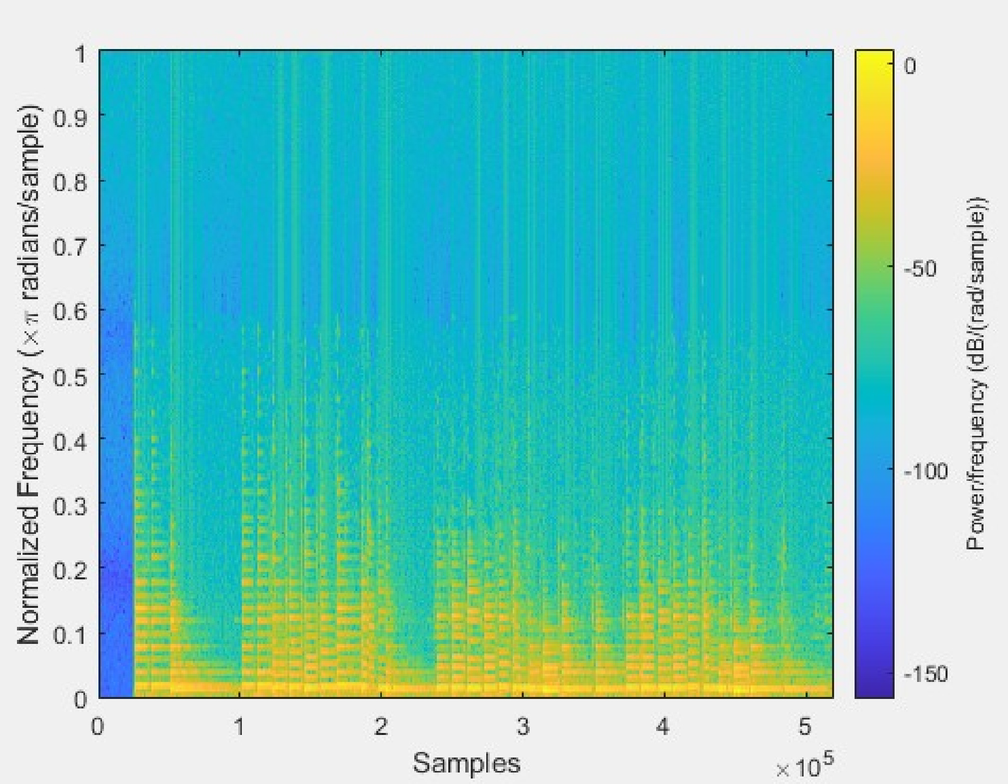
Considerações sobre Janelas … 6

```
close all
clear
clc
%
load('VBem.mat')
sound(kSs, fs)
close all;spectrogram(kSs,512,0, 'yaxis')
```

Reparem que se processou o sinal todo.

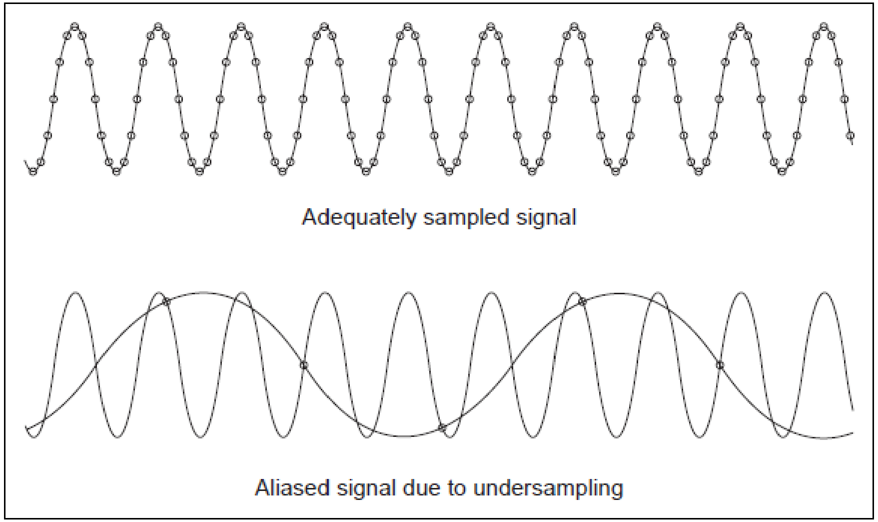
(Mostrar o video)

Espectrograma:
Diagrama tempo-frequência



Aliasing

Aliasing - Sobreposição espectral



Aliasing

Aliasing - Sobreposição espectral

Figure shows the alias frequencies that appear when the signal with real components at 25, 70, 160, and 510 Hz is sampled at 100 Hz. Alias frequencies appear at 10, 30, and 40 Hz.

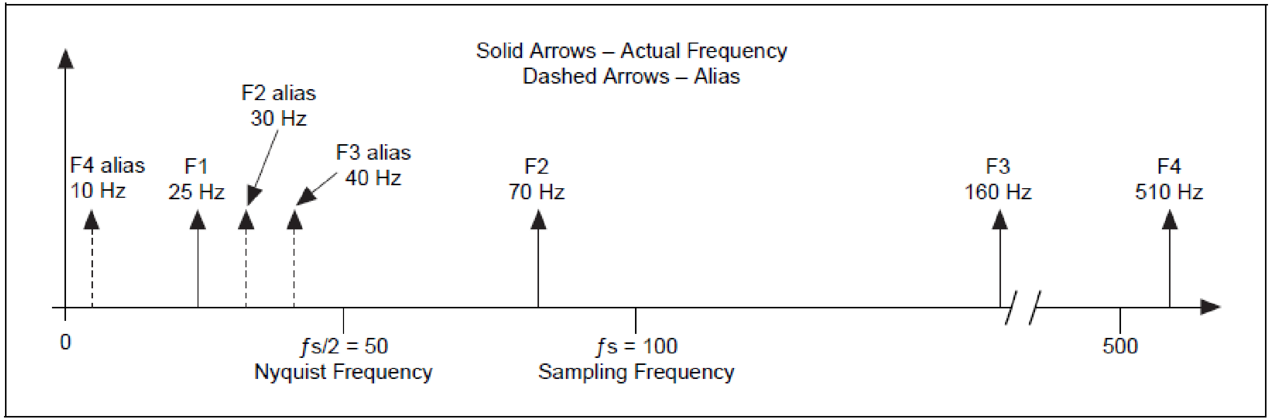


Figure Alias Frequencies Resulting from Sampling a Signal at 100 Hz That Contains Frequency Components Greater than or Equal to 50 Hz

Notar a circularidade (100= f_s): 100 é zero, 200 é zero, 500 é zero

150 é 50, 250 é 50, 350 é 50

$50 + x = 50 - x$

$n \times 100 + x = x$

Porque f_s é zero!

Aliasing

Aliasing - Sobreposição espectral

Notar a circularidade (150= f_s): 150 é zero, 300 é zero, 4500 é zero

225 é 75, 250 é 50? 350 é ___ ?

$75 + x = 75 - x$

$n \times 150 + x = x$

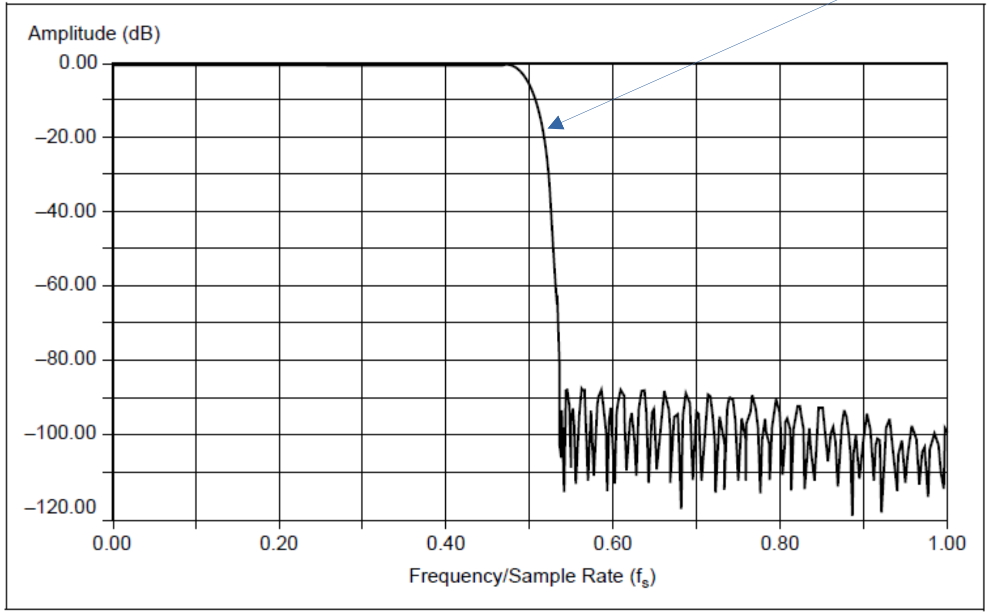
Responder pelo Chat (em privado, sff)

Aliasing

Aliasing - Sobreposição espectral

Limitations of the Acquisition Front End

Pode originar algum aliasing



Um exemplo típico (Reparar que não diz nada sobre a fase)

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O caso Biosemi (No nosso laboratório)

Specifications for biopotential measurement system, type ActiveTwo Mk2 with two-wire active electrodes :

Notar bem que a aquisição é muito mais rápida que a banda

Sample-rate options: (sample rate is adjustable by user)	2048 Hz	4096 Hz	8192 Hz	16,384 Hz
Max. number of channels @ selected sample rate:	280	280	280	152
Bandwidth (-3dB):	DC - 400 Hz	DC - 800 Hz	DC - 1600 Hz	DC - 3200 Hz
Low-pass response	5^{th} order cascaded integrator-comb (CIC) digital filter			
High-pass response	fully DC coupled			
Digitalization:	24 bit, 4^{th} order Delta-Sigma modulator with 64x oversampling, one converter per channel			
Sampling skew:	< 10 ps			
Absolute sample rate accuracy (over temp range: 0-70 C)	0.1 Hz	0.2 Hz	0.4 Hz	0.8 Hz
Relative sample rate accuracy (jitter)	< 200 ps			
Quantization-resolution	LSB = 31.25 nV, guaranteed no missing codes			
Gain accuracy:	0,3 %			
Anti aliasing filter	fixed first order analog filter, -3dB at 3.6 kHz			

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O caso Biosemi (No nosso laboratório)

Mas nem tudo são rosas….

BioSemi

Introduction

BioSemi is the EEG signal acquisition device used at SCCN. The time it takes for a BioSemi amplifier to send its data to a computer program that timestamps each sample using labstreaminglayer was measured by Matthew Grivich using a National Instruments data acquisition device (NIdaq) as a control clock. This experiment is detailed here. In that case a latency of 7.72ms was measured.

Experimental Procedure

In order to verify these results, we use the same procedure. The NIdaq program used to generate the signal and the markers can be downloaded here. The program and the device patch is setup to:

- generate 200ms pulses of 200mv every second out of the NIdaq output
- feed the voltage signal back into the NIdaq input
- feed the same signal into BioSemi
- send an LSL marker when the signal (in software) goes above 100mv
- find the time at which the BioSemi signal goes above 100mv
- compare the two markers -- their difference is the latency of BioSemi

O tempo de latência é importante
se se pretender controlar um Drone

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Terminando:

Apresentação para a próxima aula: (27 Abr)

Determine o espectrograma do Dmonky.mat

Explique as opções que fez quanto à escolha e duração da janela

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Painted on trees, sidewalks, tiles, etc... the scallop shell ('Vieira' in Galician and Portuguese) will help you find your way to Santiago.

WHERE DID THE SCALLOP SHELL COME FROM?

There are many stories, legends, and myths trying to explain the ancient link between the scallop shell and the Camino de Santiago (Way of St. James).

It is no coincidence that in French the scallop is called Coquille Saint Jacques, while in German scallops are called 'Jakobsmuscheln' (James mussels).

written by Maria

Marketing Manager Maria is from Viveiro, in the misty and beautiful northern coast of Galicia, and now calls Ireland her adopted home. She adores Santiago, where she studied Journalism at Santiago de Compostela

OBRIGADO