Using Publish

(modified from Chebfun toolbox for DSP)

This is an example of using publish. First you need to change the publish options (pull down Publish|Edit publish options) to generate a pdf file (and if you want also the target directory)

If you are working under Windows you should also be able to publish to an MS Word Document (doc). For more information type "help publish" at the prompt (that option does not appear in my laptop because I am running Linux)

Note that you can also insert formating tags by selecting the with the mouse.

Any interval $[a, b]$ can be scaled to $[-1, 1]$, so most of the time, we shall just talk about $[-1, 1]$.

Let n be a positive integer:

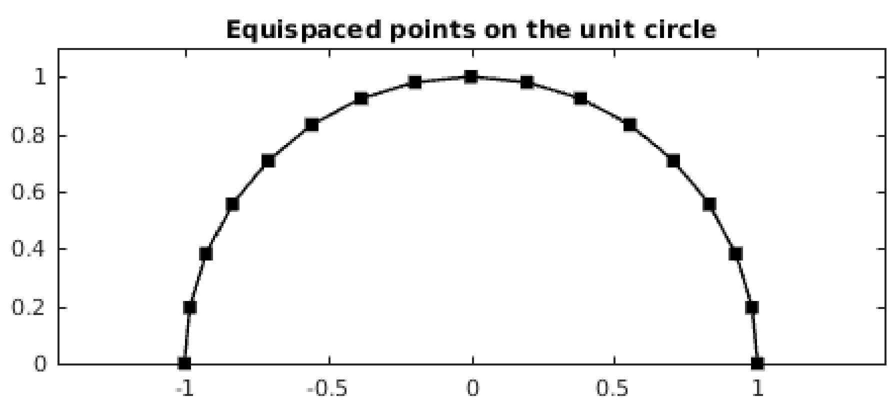
```
n = 16;
```

Consider $n + 1$ equally spaced angles $\{\theta_j\}$ from 0 to π:

```
tt = linspace(0,pi,n+1);
```

We can think of these as the arguments of $n + 1$ points $\{z_j\}$ on the upper half of the unit circle in the complex plane. These are the $(2n$ th roots of unity lying in the closed upper half-plane:

```
zz = exp(1i*tt);
hold off, plot(zz,'.-k'), axis equal, ylim([0 1.1])
FS = 'fontsize';
title('Equispaced points on the unit circle',FS,9)
```



The *Chebyshev points* associated with the parameter n are the real parts of these points,

Some authors use the terms *Chebyshev--Lobatto points*, *Chebyshev extreme points*, or *Chebyshev points of the second kind*, but as these are the points most often used in practical computation, we shall just say Chebyshev points.

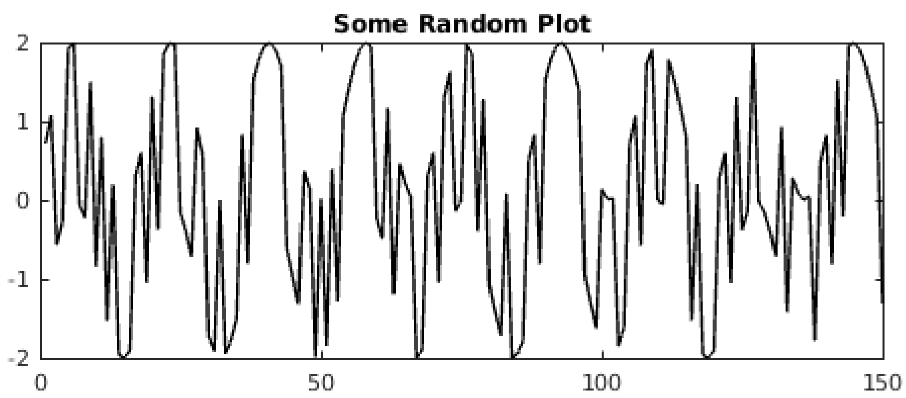
Another way to define the Chebyshev points is in terms of the original angles,

```
xx = cos(tt);
```

They cluster near 1 and -1, with the average spacing as $n \to \infty$ being given by a density function with square root singularities at both ends (Exercise 2.2).

Polynomial interpolants through equally spaced points have terrible properties, as we shall see in Chapters 11--15. Polynomial interpolants through Chebyshev points, however, are excellent. It is the clustering near the ends of the interval that makes the difference, and other sets of points with similar clustering, like Legendre points (Chapter 17), have similarly good behavior. The explanation of this fact has a lot to do with potential theory, a subject we shall introduce in Chapter 12. Specifically, what makes Chebyshev or Legendre points effective is that each one has approximately the same average distance from the others, as measured in the sense of the geometric mean. On the interval $[-1,1]$, this distance is about $1/2$ (Exercise 2.6).

```
x=linspace(1,10,150);
f = sin(6*x) + sign(sin(x+exp(2*x)));
hold off, plot(f,'k')
title('Some Random Plot',FS,9)
```



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