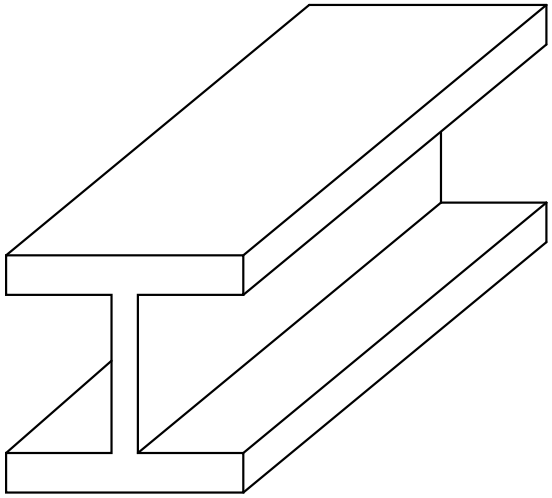
CEE384

Taylor Series

Approximating Functions with Polynomials



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1 Motivation

There are many functions that are just a bit annoying. Instead of dealing with the actual function we want to deal with a much simpler polynomial approximation of that function. For instance, the familiar trigonometric functions have known values at discrete points but calculating the cosine of a value not at a particular point is not directly possible without a numerical approximation.

We will begin by looking at the sin function. Essentially we want to make the function sin equal to some polynomial

$$\sin(x) = a_0 + a_1 x + a_2 x^2 + a_3 x^3 \tag{1}$$

We have two problems. 1) we don't currently have a value for x and 2) We don't have enough equations to determine the coefficients in the Taylor polynomial.

Problem one is pretty easy to solve. We just need to pick a point, x, to center our approximation about. This should be a convenient point that we know the value of the function at. $x = 0$ will do for this example.

The second problem can be solved by generating more equations.

Figure 1 shows this third order Taylor Polynomial.

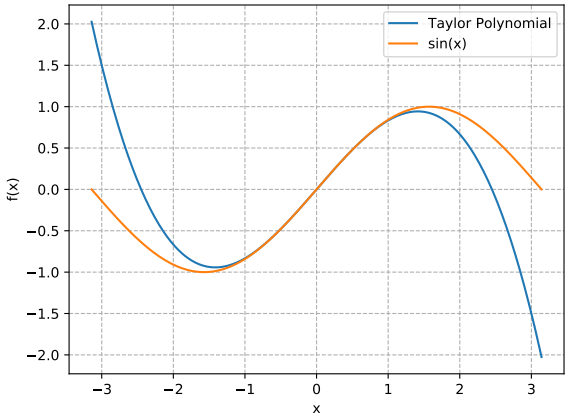

Figure 1: 3rd order Taylor Polynomial for sin

References