The solution of Numerical Algebraic and Transcendental Equations

Graphical Methods:

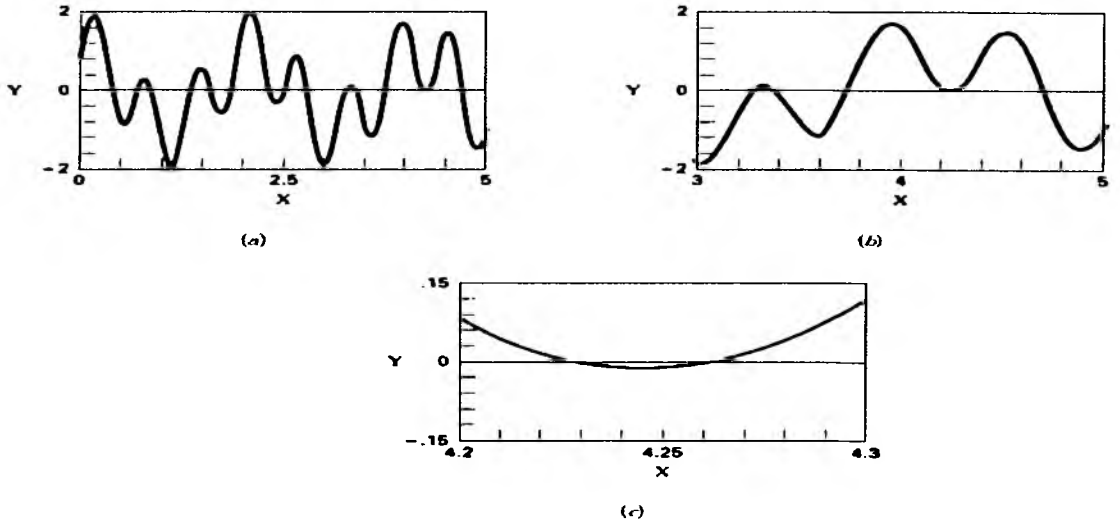
A simple method for obtaining an estimate of the root of the equation $f(x) = 0$ is to make a plot of the function and observe where it crosses the x axis. This point, which represents the x value for which $f(x) = 0$, provides a rough approximation of the root.

Example 1: Use the graphical approach to determine the locate roots of equations. The function $f(x) = \sin 10x + \cos 3x$, has several roots over the range $x = 0$ to $x = 5$. Use computer graphics to gain insight in to the behavior of this function.

Solution: Packages such as Excel and MATLAB software can be used to generate plots.

Figure 5.4*a* is a plot of $f(x)$ from $x = 0$ to $x = 5$. This plot suggests the presence of several roots, including a possible double root at about $x = 4.2$ where $f(x)$ appears to be tangent to has several roots over the range $x = 0$ to $x = 5$.

The progressive enlargement of $f(x) = \sin 10x + \cos 3x$ by the computer. Such interactive graphics permits the analyst to determine that two distinct roots exist between $x = 4.2$ and $x = 4.3$



A more detailed picture of the behavior of $f(x)$ is obtained by changing the plotting range from $x = 3$ to $x = 5$, as shown in Fig. 5.4*b*. Finally, in Fig. 5.4*c*, the vertical scale is narrowed further to $f(x) = -0.15$ to $f(x) = 0.15$ and the horizontal scale is narrowed to $x = 4.2$ to $x = 4.3$. This plot shows clearly that a double root does not exist in this region and that in fact there are two distinct roots at about $x = 4.23$ and $x = 4.26$.