In summary, the zeros and poles of a transfer function play a crucial role in determining the frequency response and stability of a system. They can be used to design filters, controllers, and other types of systems by appropriately placing them in the complex plane.

Example 1: Find the zeros and poles of the transfer function $H(s) = (s+2)/(s^2+3s+2)$.

Solution: To find the zeros and poles, we need to factorize the numerator and denominator of the transfer function. $H(s) = (s+2)/(s+1)(s+2)$ The zeros are the values of s that make the numerator zero, which is $s=-2$. The poles are the values of s that make the denominator zero, which are $s=-1$ and $s=-2$.

Example 2: Find the zeros and poles of the transfer function $H(s) = (s+1)(s+2)/(s-1)(s-2)$.

Solution: $H(s) = (s+1)(s+2)/(s-1)(s-2)$ The zeros are the values of s that make the numerator zero, which are $s=-1$ and $s=-2$. The poles are the values of s that make the denominator zero, which are $s=1$ and $s=2$.

Example 3: Find the zeros and poles of the transfer function $H(s) = (s^2+4s+4)/(s^2+6s+9)$.

Solution: $H(s) = (s+2)^2/(s+3)^2$ The zeros are the values of s that make the numerator zero, which is $s=-2$. The poles are the values of s that make the denominator zero, which is $s=-3$ (a double pole).

Example 4: Find the zeros and poles of the transfer function $H(s) = s/(s^2+4s+3)$.

Solution: $H(s) = s/(s+1)(s+3)$ The zeros are the values of s that make the numerator zero, which is $s=0$. The poles are the values of s that make the denominator zero, which are $s=-1$ and $s=-3$.

Example 5: Find the zeros and poles of the transfer function $H(s) = 1/(s^2+2s+2)$.

Solution: $H(s) = 1/(s+1+j)(s+1-j)$ The zeros are the values of s that make the numerator zero, which is none. The poles are the values of s that make the denominator zero, which are $s=-1+j$ and $s=-1-j$ (complex conjugate poles).

These are some examples of finding zeros and poles of transfer functions. The knowledge of zeros and poles is useful in various areas of engineering, including control systems, signal processing, and circuit analysis.

Transfer Function of Closed Loop systems:

The transfer function of a closed-loop system is the ratio of the output of the system to its input, in the Laplace domain. The closed-loop transfer function is also known as the feedback transfer function, since it takes into account the feedback path in the system.