Example 9-9: Consider a DTFT function expressed as

$$H(e^{j\hat{\omega}}) = (1 + \cos 2\hat{\omega})e^{-j3\hat{\omega}}$$

Using the inverse Euler formula for the cosine term gives

$$H(e^{j\hat{\omega}}) = \left(1 + \frac{e^{j2\hat{\omega}} + e^{-j2\hat{\omega}}}{2}\right) e^{-j3\hat{\omega}} = (e^{j\hat{\omega}})^{-3} + \tfrac{1}{2}(e^{j\hat{\omega}})^{-1} + \tfrac{1}{2}(e^{j\hat{\omega}})^{-5}$$

Making the substitution $e^{j\hat{\omega}} = z$ gives

$$H(z) = z^{-3} + \tfrac{1}{2}z^{-1} + \tfrac{1}{2}z^{-5} = \tfrac{1}{2}z^{-1} + z^{-3} + \tfrac{1}{2}z^{-5}$$

If the impulse response of the system is needed, the inverse z-transform gives

$$h[n] = \tfrac{1}{2}\delta[n-1] + \delta[n-3] + \tfrac{1}{2}\delta[n-5]$$

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