Concept Question 3-7: When evaluating the expansion coefficients of a function containing repeated poles, is it more practical to start by evaluating the coefficient of the fraction with the lowest-order pole or that with the highest-order pole? Why?

Highest order. See the procedure below:

Repeated Real Poles

Expansion coefficients B_1 to B_m are determined through a procedure that involves multiplication by $(\mathbf{s} - p)^m$, differentiation with respect to $\mathbf{s}$, and evaluation at $\mathbf{s} = p$:

$$B_j = \left\{ \frac{1}{(m-j)!} \frac{d^{m-j}}{d\mathbf{s}^{m-j}} [(\mathbf{s} - p)^m \, \mathbf{X}(\mathbf{s})] \right\} \bigg|_{\mathbf{s}=p}, \quad j = 1, 2, \ldots, m. \tag{3.71}$$

For the m, $m-1$, and $m-2$ terms, Eq. (3.71) reduces to

$$B_m = (\mathbf{s} - p)^m \, \mathbf{X}(\mathbf{s})|_{\mathbf{s}=p}, \tag{3.72a}$$

$$B_{m-1} = \left\{ \frac{d}{d\mathbf{s}} [(\mathbf{s} - p)^m \, \mathbf{X}(\mathbf{s})] \right\} \bigg|_{\mathbf{s}=p}, \tag{3.72b}$$

$$B_{m-2} = \left\{ \frac{1}{2!} \frac{d^2}{d\mathbf{s}^2} [(\mathbf{s} - p)^m \, \mathbf{X}(\mathbf{s})] \right\} \bigg|_{\mathbf{s}=p}. \tag{3.72c}$$