If \( P(s) \) and \( Q(s) \) are polynomials in \( s \), and if the degree of \( P(s) \) is less than the degree of \( Q(s) \), then \( \mathcal{L}^{-1}\{P(s)/Q(s)\} \) exists and can be found by first writing \( P(s)/Q(s) \) as its partial fraction decomposition. Since most readers have already encountered this technique in a course in calculus, we simply state the important facts related to the subject.

### Rules for Partial Fraction Decomposition

\[
\frac{P(s)}{Q(s)} = \text{terms of the partial fraction decomposition}
\]

1. **Linear Factor:** For each factor \((as + b)\) in the denominator of \( Q(s) \), there corresponds a term of the form

\[
\frac{A}{as + b}
\]

in the partial fraction decomposition.

2. **Power of Linear Factor:** For each power \((as + b)^n\) of a linear factor in the denominator of \( Q(s) \), there correspond terms of the form

\[
\frac{A_1}{as + b} + \frac{A_2}{(as + b)^2} + \cdots + \frac{A_n}{(as + b)^n}
\]

in the partial fraction decomposition.

3. **Quadratic Factor:** For each quadratic factor \((as^2 + bs + c)\) in the denominator \( Q(s) \), there corresponds term(s) of the form

\[
\frac{As + B}{as^2 + bs + c}
\]

in the partial fraction decomposition.

4. **Power of Quadratic Factor:** For each power \((as^2 + bs + c)^n\) of a quadratic factor in the denominator \( Q(s) \), there correspond terms of the form

\[
\frac{A_1 s + B_1}{as^2 + bs + c} + \frac{A_2 s + B_2}{(as^2 + bs + c)^2} + \cdots + \frac{A_n s + B_n}{(as^2 + bs + c)^n}
\]

in the partial fraction decomposition.

Ref. from Farlow