The function **PARTIAL** finds the equivalent partial fraction expansion of the ratio of two polynomials $B(s)/A(s)$.

$$\frac{B\left(s\right)}{A\left(s\right)} = \frac{r\left(1\right)}{s-p\left(1\right)} + \frac{r\left(3\right)}{s-p\left(2\right)} + \ldots + \frac{r\left(n\right)}{s-p\left(n\right)}$$

Vectors B and A specify the coefficients of the numerator and denominator polynomials in descending powers of s.

The function **ROOTS** computes *all the roots* (not like cZeros) of the polynomial whose coefficients are the elements of the vector C. If C has $N+1$ components, the polynomial is $c\left(0\right)s^N+\ldots+c\left(N\right)s+c\left(N+1\right)$.

Example 1:

$$\frac{B\left(s\right)}{A\left(s\right)} = \frac{s^2-1}{s^3-4s^2-8}$$

$partial(\{1,0,-1\},\{1,-4,0,-8\})$ give

$$\frac{B\left(s\right)}{A\left(s\right)} \approx \frac{.1002+.1932i}{s+.2056+1.331i} + \frac{.1002-.1932i}{s+.2056-1.331i} + \frac{.7996}{s-4.411}$$

Example 2:

$$\frac{B\left(s\right)}{A\left(s\right)} = \frac{s-1}{s^3+s^2}$$

This expression have a pole of multiplicity 2 on $s=0$

For the expression above (on $A(s)$) $roots(\{1,1,0,0\})$ give $\{-1,0,0\}$ this is $s=-1$ and $s=0$ and $s=0$

not like $cZeros(s^3+s^2,s)$ who give $\{-1,0\}$ this is $s=-1$ and $s=0$

so the function $partial(\{1,-1\},\{1,1,0,0\})$ give

$$\frac{B\left(s\right)}{A\left(s\right)} = \frac{-2}{s+1} + \frac{2}{s} - \frac{1}{s^2}$$

I think these are useful functions.

For example, is much easier to calculate Laplace Transformation. Or in my case, to project digital filters.

24/05/2003

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