1 BLOM

1.1 Installation

Follow the instructions below to download and install BLOM.

1. Go to the BLOM download page: http://www.mpclab.net/Trac/wiki/BLOMSetup
2. Download BLOM "As a zip file"
3. Extract the "trunk" folder into your "H:" drive
4. Start Matlab and type `addpath(genpath('H:\trunk'))` into the command window. This will add BLOM to your path.
5. Type `RunHelloWorldR2` into the command window to run the test program.

1.2 Polyblocks

BLOM supports functions that are a quotient of polynomial-like functions with a special structure. These polynomial-like functions must be a sum of terms which are products of powers or "basic" functions of the variables. The basic functions currently supported are exponentials, logarithms, sines, cosines, hyperbolic tangents, and inverse tangents. More precisely, the functions must be of the form

$$h(x_1,...,x_n) = \frac{f(x_1,...,x_n)}{g(x_1,...,x_n)}, \text{ where } f(x_1,...,x_n) = \sum_{i=1}^{p}\prod_{j=1}^{n} a_{ij}(x_j),\ g(x_1,...,x_n) = \sum_{i=1}^{q}\prod_{j=1}^{n} b_{ij}(x_j),$$

and a_{ij} and b_{ij} are powers or basic functions. For example, the following function is acceptable in BLOM.

$$h(x_1,x_2,x_3) = \frac{f(x_1,x_2,x_3)}{g(x_1,x_2,x_3)} = \frac{\overbrace{x_1^2 x_2 \cos(x_3)}^{\text{term 1}} + \overbrace{e^{x_1} x_2^3 x_3^5}^{\text{term 2}} + \overbrace{x_1^2 \log(x_2) x_3^3}^{\text{term 3}}}{\underbrace{x_1 \tan^{-1}(x_2)}_{\text{term 1}} + \underbrace{\tanh(x_2) x_3^5}_{\text{term 2}}}$$

In Simulink, the user uses the 'PolyBlock' function block to program these functions. Multiple functions can be specified at the same time using one PolyBlock. The numerator, $f(x)$, and denominator, $g(x)$, are specified separately using a terms matrix A and coefficient matrix C for each.

The ij-th entry of A corresponds to the power or basic function of the j-th variable in the i-th term. Therefore, the i-th row of A corresponds to the i-th term in the polynomial-like function. The ij-th entry of C corresponds to the coefficient of the j-th term in the i-th polynomial-like function. Therefore, the i-th row of C represents the i-th polynomial-like function.

For example, suppose we would like to program the following two functions using one PolyBlock.

$$h_1(x_1,x_2) = \frac{f_1(x_1,x_2)}{g_1(x_1,x_2)} = \frac{x_1^2 x_2 + 2x_1\cos(x_2)}{x_2}$$
$$h_2(x_1,x_2) = \frac{f_2(x_1,x_2)}{g_2(x_1,x_2)} = \frac{3\sin(x_1) + e^{x_2}}{\tanh(x_1)x_2^3 + 4x_2}$$

For the numerators $f_1(x)$ and $f_2(x)$, the A and C matrices are

$$A = \begin{bmatrix} 2 & 1 \\ 1 & \texttt{BLOM\_FunctionCode('cos')} \\ \texttt{BLOM\_FunctionCode('sin')} & 0 \\ 0 & \texttt{BLOM\_FunctionCode('exp')} \end{bmatrix},\ C = \begin{bmatrix} 1 & 2 & 0 & 0 \\ 0 & 0 & 3 & 1 \end{bmatrix}$$

For the denominators $g_1(x)$ and $g_2(x)$, the A and C matrices are

$$A = \begin{bmatrix} 0 & 1 \\ \texttt{BLOM\_FunctionCode('tanh')} & 3 \end{bmatrix}, \; C = \begin{bmatrix} 1 & 0 \\ 4 & 1 \end{bmatrix}$$