> *restart;*
>

Load lfs.zip from http://www.ccas.ru/ca/_media/lfs.zip
This archive includes two files: lfs.ind and lfs.lib.
Put these files to some directory, for example to ''/usr/userlib''

> *libname* := "/usr/userlib/lfs.lib", *libname* :
>

The system with polymonial coefficients

> *Matrix*(2, 2, [[x, x], [x, x]]) · *diff*(y(x), x) + *Matrix*(2, 2, [[1, x^2 + 1], [− x, 0]]) · y(x) = 0

$$\begin{bmatrix} x & x \\ x & x \end{bmatrix} \cdot \left(\frac{d}{dx} y(x)\right) + \begin{bmatrix} 1 & x^2+1 \\ -x & 0 \end{bmatrix} \cdot y(x) = 0 \qquad \textbf{(1.1)}$$

> *LFS:-InducedRecurrence*((**1.1**), y(x), c(n))

$$\begin{bmatrix} n+1 & n+1 \\ n & n \end{bmatrix} \cdot c(n) + \begin{bmatrix} 0 & 0 \\ -1 & 0 \end{bmatrix} \cdot c(n-1) + \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \cdot c(n-2) = 0 \qquad \textbf{(1.2)}$$

> *LFS:-EG*('*lead*', (**1.2**), c(n))

$$\begin{bmatrix} -n-2 & 0 \\ n & n \end{bmatrix} \cdot c(n) + \begin{bmatrix} 0 & -n-1 \\ -1 & 0 \end{bmatrix} \cdot c(n-1) = 0, \mathit{true} \qquad \textbf{(1.3)}$$

The procedure returns a list of Vectors of truncated series that forms a basis of Laurent solution space of the given system:

> *LFS:-LaurentSolution*((**1.1**), y(x), c(n))

$$\left[\begin{bmatrix} \frac{2}{x^2} + 1 + \left(\sum_{n=1}^{\infty} c_1(n)\, x^n\right) \\ -\frac{2}{x^2} - \frac{2}{x} + 1 + \left(\sum_{n=1}^{\infty} c_2(n)\, x^n\right) \end{bmatrix}\right] \qquad \textbf{(1.4)}$$

The system with series coefficients

> *Matrix*(2, 2, [[1 + x^2 , x^2 + *Sum*(x^k, k = 3 .. infinity)], [x^2 + *Sum*(Xi(k)*x^k, k = 3 .. infinity), x^2 + *Sum*((k + 1)*x^k, k = 3 .. infinity)]]) . theta(y(x), x, 1) + *Matrix*(2, 2, [[x^2 + *Sum*(x^k/k!, k = 3 .. infinity), x^2 + 3*Sum(x^k, k = 3 .. infinity)], [1 + x + x^2 + *Sum*((k^2 + 2*k + 1 - (k + 1)^2)*x^k, k = 3 .. infinity), x + x^2 - *Sum*(x^k, k = 3 .. infinity)]]) . y(x) = 0

$$\begin{bmatrix} x^2+1 & x^2 + \left(\sum_{k=3}^{\infty} x^k\right) \\ x^2 + \left(\sum_{k=3}^{\infty} \Xi(k)\, x^k\right) & x^2 + \left(\sum_{k=3}^{\infty} (k+1)\, x^k\right) \end{bmatrix} \cdot \theta(y(x), x, 1) \qquad \textbf{(2.1)}$$

$$+\begin{bmatrix} x^2+\left(\sum_{k=3}^{\infty}\frac{x^k}{k!}\right) & x^2+3\left(\sum_{k=3}^{\infty}x^k\right) \\ 1+x+x^2+\left(\sum_{k=3}^{\infty}\left(k^2+2k+1-(k+1)^2\right)x^k\right) & x+x^2-\left(\sum_{k=3}^{\infty}x^k\right)\end{bmatrix}\cdot y(x)=0$$

The number of computed initial terms of the induced recurrence with infinity order can be set by the option 'terms':

> $LFS\text{:-}InducedRecurrence(\mathbf{(2.1)}, \text{theta}, y(x), c(n), terms=3)$

$$\begin{bmatrix} n & 0 \\ 1 & 0\end{bmatrix}\cdot c(n)+\begin{bmatrix} 0 & 0 \\ 1 & 1\end{bmatrix}\cdot c(n-1)+\begin{bmatrix} n-1 & n-1 \\ n-1 & n-1\end{bmatrix}\cdot c(n-2)+\ldots=0 \qquad \mathbf{(2.2)}$$

The procedure returns a list of Vectors of truncated series that forms a basis of Laurent solution space of the given system:

> $LFS\text{:-}LaurentSolution(\mathbf{(2.1)}, \text{theta}, y(x), c(n))$

$$\left[\begin{bmatrix} -1+\left(\sum_{n=1}^{\infty}c_1(n)\,x^n\right) \\ \frac{1}{x}+1+\left(\sum_{n=1}^{\infty}c_2(n)\,x^n\right)\end{bmatrix}\right] \qquad \mathbf{(2.3)}$$

The truncation degree of solutions can be set be the option 'degree':

> $LFS\text{:-}LaurentSolution(\mathbf{(2.1)}, \text{theta}, y(x), c(n), 'degree'=3)$

$$\left[\begin{bmatrix} -1-x^2-\frac{101x^3}{18}+\left(\sum_{n=4}^{\infty}c_1(n)\,x^n\right) \\ \frac{1}{x}+1+6x+\frac{29x^2}{18}+\frac{425x^3}{288}+\left(\sum_{n=4}^{\infty}c_2(n)\,x^n\right)\end{bmatrix}\right] \qquad \mathbf{(2.4)}$$

>