OpenXM/Risa/Asir-Contrib

OpenXM/Risa/Asir-Contrib User's Manual (日本語版)
Edition 1.3.2-3 for OpenXM/Asir2000
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by OpenXM Developing Team

1 はじめに

数式処理システムasir はOpenXM プロトコル(Open message eXchange for Mathematics, http://www.openxm.org) をサポートしたサーバをコンポーネントとして利用できる. これらのサーバを呼ぶためのインタフェース関数はファイルOpenXM/rc/asirrc をロードすることによりシステムに読み込まれる. Risa/Asir (OpenXM 配布版) では起動時に自動的にこのファイルが読まれる. Risa/Asir (OpenXM 配布版) は, このマニュアルではOpenXM/Risa/Asir と呼ぶ. このマニュアルではasir 用のこれらの関数およびユーザ言語で書かれた数学関数およびユーティリティ関数を説明する.

HEAD branch に同期した最新版の asir-contrib マニュアルはhttp://www.math.kobe-u.ac.jp/OpenXM/Current/doc/index-doc-ja.html を参照.

OpenXM プロトコルの技術的詳細については, $(OpenXM_HOME)/doc/OpenXM-specs にあるファイルopenxm-jp.tex を見て下さい.

それでは, あなたの計算機上で数学をお楽しみ下さい.

List of contributors:

- Maekawa, Masahide (Oct., 1999 – : CVS server)
- Noro, Masayuki (Jan., 1996 – : OpenXM Protocol OXRFC-100, asir2000)
- Ohara, Katsuyoshi (Jan., 1998 – : ox_math, oxc OXRFC-101)
- Takayama, Nobuki (Jan., 1996 – : OpenXM Protocol OXRFC-100, kan/sm1, asir-contrib)
- Tamura, Yasushi (Nov., 1998 – : OpenMath proxy, tfb)
- Fujimoto, Mitsushi (Windows)
- Iwane, Hidenao (Knapsack factorizer)
- Nakayama, Hiromasa (Gaussian elimination)
- Okutani, Yukio (Oct., 1999 – Feb., 2000 : matrix, diff, ...)
- Stillman, Mike (Macaulay 2 client and server)
- Tsai, Harrison (Macaulay 2 client and server)

この Contrib パッケージの著作権については, `OpenXM/Copyright` を見て下さい.
有用だとおもいますが無保証です.

2 Asir/Contrib のロード方法.

`OpenXM/rc/asirrc` をロードすることにより Asir/Contrib の主な関数が利用可能となる. OpenXM/Risa/Asir では`ASIR_CONFIG` 環境変数によりこのファイルを起動時に読みこんでいる. `names.rr` が Asir/Contrib のトップレベルのファイルである. このファイルよりその他のファイルが読み込まれている. 一部のパッケージは`names.rr` からは読み込まれないので, 明示的に読み込む必要がある.

A sample of `asirrc` to use Asir/Contrib.

```
load("gr")$
load("primdec")$
load("katsura")$
load("bfct")$
load("names.rr")$
load("oxrfc103.rr")$
User_asirrc=which(getenv("HOME")+"/.asirrc")$
if (type(User_asirrc)!=0)
   if (!ctrl("quiet_mode")) print("Loading ~/.asirrc")$
   load(User_asirrc)$
else $
end$
```

3 Asir Contrib の函数名について

Asir Contrib には(1) 標準的な名前で定義された数学函数(`names.rr` および(2) Asir 標準函数以外の有用なライブラリ函数および(3) OpenXM サーバを asir から呼ぶための函数が含まれている.

Asir Contrib の函数名はモジュール化されているかまたは次の形をしている: **カテゴリ名_函数名**

標準的な数学函数は実体へのラッパーである. たとえば`sm1.hilbert` は OpenXM サーバ`sm1` の Hilbert 函数の計算函数を呼び出す函数である. 一方`poly_hilbert_polynomial` は Asir Contrib の Hilbert 函数を計算するための(1) に属する標準的な函数名である. 標準函数`poly_hilbert_polynomial` は, 現在`sm1.hilbert` を呼び出して Hilbert 函数を計算しているが, これは将来変更されるかもしれない. たとえば, Asir 言語で記述された有用なライブラリ函数集`commutativeRing.rr` が開発されて Hilbert 函数の計算函数`commutativeRing_hilbert_polynomial` が含まれるようになったら, 標準函数`poly_hilbert_polynomial` は, `commutativeRing_hilbert_polynomial` を呼び出して Hilbert 函数を計算するようになるかもしれない. したがって, ユーザプログラムは標準数学函数名を用いるのが望ましい.

標準数学函数名は, OpenXM project において, 全てのプロジェクトで共通の仕様を持つように努力している. たとえば, kan/k0 も Asir Contrib と同様の標準数学函数名を持つ予定である. 現在実験的に数学函数のカテゴリ`complex` 複体(複素数でない) のマニュアルを kan/k0, asir/contrib で共通化を試みている.

以下の章は, 標準数学函数の解説をおこない, それからライブラリ函数, それから, OpenXM サーバのインタフェースの説明をおこなう.

4 Windows 版 Asir-contrib

Windows でも不完全ながら asir-contrib が動作する. 現在, 外部コンポーネント sm1 および, 外部コンポーネントを利用しない asir-contrib の関数が動作する. Cygwin 環境では外部コンポーネント sm1, phc が動作する. その他の外部コンポーネントは動作しない.

次の関数は Windows では動作しない. Windows での cygwin 環境では動作する場合がある.

- `gnuplot.*`
- `om.*`
- `mathematica.*`
- `phc.*`
- `print_dvi_form`
- `print_gif_form`
- `print_open_math_xml_form`
- `print_png_form`
- `print_xdvi_form`
- `print_xv_form`
- `tigers_xv_form`

5 基礎(標準函数)

5.0.1 base_cancel

`base_cancel(`*S*`)`
: It simplifies S by canceling the common factors of denominators and numerators.

Example:

```
base_cancel([(x-1)/(x^2-1), (x-1)/(x^3-1)]);
```

5.0.2 base_choose

`base_choose(`*L*`,`*M*`)`
: It returns the list of the order M subsets of L.

Example:

```
base_choose([1,2,3],2);
```

It outputs all the order 2 subsets of the set $\{1, 2, 3\}$

5.0.3 base_f_definedp

`base_f_definedp(`*Func*`)`
: returns 1 if the function Func is defined.

5.0.4 base_flatten

`base_flatten(`*S*`)`
: It flattens a nested list S.

Example:

```
base_flatten([[1,2,3],4]);
```

5.0.5 base_intersection

`base_intersection(`*A*`,`*B*`)`
: It returns the intersection of A and B as a set.

Example:

```
base_intersection([1,2,3],[2,3,5,[6,5]]);
```

5.0.6 base_is_asir2018

`base_is_asir2018()`
: returns 1 if the system is asir2018.

5.0.7 base_is_equal

`base_is_equal(`*L1*`,`*L2*`)`
: returns 1 if the objects L1 and L2 are equal else return 0

5.0.8 base_ith

`base_ith(A,I)`
: It returns A[I].

Example:

```
R=[[x,10],[y,20]]; map(base_ith,R,0);
```

5.0.9 base_makelist

`base_makelist(Obj,K,B,T)`
: base_makelist generate a list from Obj where K runs in [B,T]. Options are qt=1 (keep quote data), step (step size). When B is a list, T is ignored and K runs in B.

Example 0:

```
base_makelist(k^2,k,1,10);
```

Example 1:

```
map(print_input_form,base_makelist(quote(x^2),x,1,10 | qt=1, step=0.5))
```

Example 2:

```
base_makelist(quote("the "+k),k,["cat","dog"],0);
```

5.0.10 base_memberq

`base_memberq(A,S)`
: It returns 1 if A is a member of the set S else returns 0.

Example:

```
base_memberq(2,[1,2,3]);
```

5.0.11 base_permutation

`base_permutation(L)`
: It outputs all permutations of L. BUG; it uses a slow algorithm.

Example:

```
base_permutation([1,2,3,4]);
```

5.0.12 base_position

`base_position(A,S)`
: It returns the position of A in S.

Example:

```
base_position("cat",["dog","cat","monkey"]);
```

5.0.13 base_preplace

`base_preplace(`*S*`,`*Rule*`)`
: It rewrites *S* by using the rule *Rule*. psubst is used instead of subst. The replacement is not performed for function arguments.

Example:

```
base_preplace(exp(x)+x^2,[[x,a+1],[exp(x),b]]);
```

x is replaced by a+1 and exp(x) is replaced by b in exp(x)+x^2.

5.0.14 base_product

`base_product(`*Obj*`,`*K*`,`*B*`,`*T*`)`
: base_product returns the product of Obj where K runs in [B,T]. Options are qt=1 (keep quote data), step (step size). When B is a list, K runs in B and T is ignored.

Example 0:

```
base_product(k^2,k,1,10);
```

Example 1:

```
base_product(quote(x^2),x,1,10 | qt=1, step=0.5);
```

Example 2:

```
base_product(quote(x^2),x,[a,b,c],0 | qt=1);
```

5.0.15 base_prune

`base_prune(`*A*`,`*S*`)`
: It returns a list in which *A* is removed from *S*.

Example:

```
base_prune("cat",["dog","cat","monkey"]);
```

5.0.16 base_range

`base_range(`*Start*`,`*End*`)`
: It returns a list numbers [Start, Start+Step, Start+2*Step, ..., Start+n*Step] where Start+n*Step < End <= Start+(n+1)*Step Default value of step is 1.

`base_range(`*Start*`,`*End* `| step=`*Step*`=key0)`
: This function allows optional variables *step=Step*

Example:

```
base_range(0,10);
```

5.0.17 base_rebuild_opt

`base_rebuild_opt(`*Opt*`)`
: It rebuilt the option list *Opt*

Example:

```
base_rebuild_opt([[key1,1],[key2,3]] | remove_keys=["key2"]);
```

it returns [[key1,1]]

5.0.18 base_replace

`base_replace(S,Rule)`
: It rewrites S by using the rule *Rule*

Example:

```
base_replace(x^2+y^2,[[x,a+1],[y,b]]);
```

x is replaced by a+1 and y is replaced by b in x^2+y^2.

5.0.19 base_replace_n

`base_replace_n(S,Rule)`
: It rewrites S by using the rule *Rule*. It is used only for specializing variables to numbers and faster than base_replace.

Example:

```
base_replace_n(x^2+y^2,[[x,1/2],[y,2.0+3*@i]]);
```

x is replaced by 1/2 and y is replaced by 2.0+3*in x^2+y^2.

5.0.20 base_rest

`base_rest(L)`
: It returns cdr(L).

Example:

```
R=[[x,10,30],[y,20,40]]; map(base_rest,R);
```

5.0.21 base_set_intersection

`base_set_intersection(A,B)`
: $A \cap B$

Example:

```
base_set_intersection([1,2,3],[3,4,5]);
```

5.0.22 base_set_minus

`base_set_minus(A,B)`
: $A \setminus B$

Example:

```
base_set_minus([1,2,3],[3,4,5]);
```

5.0.23 base_set_union

`base_set_union(A,B)`
: $A \cup B$

Example:

```
base_set_union([1,2,3],[3,4,5]);
```

5.0.24 base_subsequenceq

`base_subsequenceq(A,B)`
: if A is a subsequence B, then it returns 1 else 0.

Example:

```
base_subsequence([3,2,5],[1,2,3,4,5]);
```

5.0.25 base_subsetq

`base_subsetq(A,B)`
: if $A \subseteq B$, then it returns 1 else 0.

Example:

```
base_subsetq([1,2],[1,2,3,4,5]);
```

5.0.26 base_subsets_of_size

`base_subsets_of_size(K,S)`
: It outputs all subsets of S of the size K. BUG; it uses a slow algorithm. Do not input a large S.

Example:

```
base_subsets_of_size(2,[3,5,3,2]);
```

5.0.27 base_sum

`base_sum(Obj,K,B,T)`
: base_sum returns the sum of Obj where K runs in [B,T]. Options are qt=1 (keep quote data), step (step size). When B is a list, K runs in B and T is ignored. When K is 0, then Obj is assumed to be a list or vector and Obj[B]+...+Obj[T] is returned.

Example 0:

```
base_sum(k^2,k,1,10);
```

Example 1:

```
base_sum(quote(x^2),x,1,10 | qt=1, step=0.5);
```

Example 2:

```
base_sum(quote(x^2),x,[a,b,c],0 | qt=1);
```

5.0.28 base_var_list

`base_var_list(Name,B,T)`
: base_var_list generate a list of variables Name+Index where Index runs on [B,T].

Example 0:

```
base_var_list(x,0,10);
```

Example 1:

```
base_var_list(x,1,4 | d = 1);
Options are d=1 (add d before the name).
```

6 数(標準数学函数)

6.0.1 number_abs

`number_abs(X)`
:

Example:

```
number_abs(-3);
```

6.0.2 number_ceiling

`number_ceiling(X)`
:

Example:

```
number_abs(1.5);
```

6.0.3 number_eval

`number_eval(X)`
:

Example:

```
number_eval([1/10^10,@pi,exp(1)]);
```

6.0.4 number_factor

`number_factor(X)`
: It factors the given integer X.

Example:

```
number_factor(20);
```

6.0.5 number_float_to_rational

`number_float_to_rational(X)`
:

Example:

```
number_float_to_rational(1.5234);
            number_setprec(30); //About 30 digits after the decimal point.  It also s
```

6.0.6 number_floor

`number_floor(X)`
:

Example:

```
number_floor(1.5);
```

6.0.7 number_imaginary_part

`number_imaginary_part(`*X*`)`
:

Example:

```
number_imaginary_part(1+2*@i);
```

6.0.8 number_is_integer

`number_is_integer(`*X*`)`
:

Example:

```
number_is_integer(2/3);
```

6.0.9 number_real_part

`number_real_part(`*X*`)`
:

Example:

```
number_real_part(1+2*@i);
```

6.0.10 number_setprec

`number_setprec(`*X*`)`
: When X is 0, it returns the current value of precision.

Example:

```
 number_setprec(30);
  number_float_to_rational(F) returns
  an approximation of F by a rational number with the accuracy
  about 30 digits after the decimal point.
  It also calls setprec(30);
```

7 微積分(標準数学函数)

8 級数(標準数学函数)

9 特殊函数(標準数学函数)

まだ書いてない.

10 行列(標準数学函数)

10.0.1 matrix_adjugate

`matrix_adjugate(`*M*`)`
: It generates the adjugate matrix of the matrix *M*.

Example:

```
matrix_adjugate(matrix_list_to_matrix([[a,b],[c,d]]));
```

10.0.2 matrix_clone

`matrix_clone(`*M*`)`
: It generates the clone of the matrix *M*.

Example:

```
matrix_clone(matrix_list_to_matrix([[1,1],[0,1]]));
```

10.0.3 matrix_det

`matrix_det(`*M*`)`
: It returns the determinant of the matrix *M*.

Example:

```
poly_factor(matrix_det([[1,x,x^2],[1,y,y^2],[1,z,z^2]]));
```

10.0.4 matrix_diagonal_matrix

`matrix_diagonal_matrix(`*L*`)`
: It returns the diagonal matrix with diagonal entries *L*.

Example:

```
matrix_diagonal_matrix([1,2,3]);
```

References:

`matrix_list_to_matrix`

10.0.5 matrix_eigenavalues

`matrix_eigenavalues(`*M*`)`
: It returns the eigenvalues of the matrix *M*. if the option num=1, it returns the numerical approximate eigenvalues.

Example:

```
matrix_eigenvalues([[x,1],[0,y]]);
```

10.0.6 matrix_gauge_transformation

`matrix_gauge_transformation(`*M*`,`*T*`,`*V*`)`
: It returns T^(-1) M T - T^(-1) dT/dV

Example:

```
matrix_gauge_transformation([[0,x],[1,x]],[[x,0],[0,1]],x);
```

10.0.7 matrix_identity_matrix

`matrix_identity_matrix(`*N*`)`
: It returns the identity matrix of the size *N*.

Example:

```
matrix_identity_matrix(5);
```

References:

`matrix_diagonal_matrix`

10.0.8 matrix_ij

`matrix_ij(`*N*`,`*II*`,`*JJ*`)`
: It returns the matrix for exchanging II-th row(col) and JJ-th row(col).

Example:

```
matrix_ij(4,0,2);
```

10.0.9 matrix_image

`matrix_image(`*M*`)`
: It computes the image of M. Redundant vectors are removed.

Example:

```
matrix_image([[1,2,3],[2,4,6],[1,0,0]]);
```

References:

`matrix_kernel`

10.0.10 matrix_inner_product

`matrix_inner_product(`*A*`,`*B*`)`
: It returns the inner product of two vectors *A* and *B*.

Example:

```
matrix_inner_product([1,2],[x,y]);
```

10.0.11 matrix_inverse

`matrix_inverse(`*M*`)`
: It returns the inverse of the matrix *M*.

Example:

```
matrix_inverse([[1,2],[0,1]]);
```

10.0.12 matrix_inverse_singular

`matrix_inverse_singular(`*Mat*`)`
: It returns a quasi-inverse matrix of Mat when it has 0-row and 0-column.

Example:

```
matrix_inverse_singular(newmat(3,3,[[1,0,2],[0,0,0],[3,0,4]]));
```

10.0.13 matrix_is_zero

`matrix_is_zero(A)`
: If it is 0 matrix or 0 vector or list consisting of 0, then it returns 1 else it returns 0.

Example:

```
matrix_is_zero(newmat(2,3));
```

10.0.14 matrix_kernel

`matrix_kernel(M)`
: It returns the basis of the kernel of the matrix M.

Example:

```
matrix_kernel([[1,1,1,1],[0,1,3,4]]);
```

10.0.15 matrix_kronecker_product

`matrix_kronecker_product(A,B)`
: Kronecker product of the matrices A and B.

Example:

```
matrix_kronecker_product([[a11,a12],[a21,a22]],[[b11,b12],[b21,b22]]);
```

10.0.16 matrix_list_to_matrix

`matrix_list_to_matrix(M)`
: It translates the list M to a matrix.

Example:

```
print_xdvi_form(matrix_list_to_matrix([[1,1],[0,2]]));
```

References:

`matrix_matrix_to_list`

10.0.17 matrix_matrix_to_list

`matrix_matrix_to_list(M)`
: It translates the matrix M to a list.

References:

`matrix_list_to_matrix`

10.0.18 matrix_ones

`matrix_ones(N)`
: It returns the vector [1 1 ... 1] of length N. When one=m, it returns [m m ... m]. When size=[p,q] is given, N is ignored and returns p by q matrix with entries 1.

`matrix_ones(N | one=m=key0,size=[p=key1,q]=key2)`
: This function allows optional variables *one=m*, *size=[p, q]*

Example:

```
vtol(matrix_ones(3));  returns the list [1,1,1]
```

10.0.19 matrix_poly_to_matrix

`matrix_poly_to_matrix(`*Poly*`,`*Rule*`)`
: Replace variables in the polynomial Poly by matrices in the Rule.

Example:

```
matrix_poly_to_matrix(x^2-1,[[x,newmat(2,2,[[2,0],[0,3]])]]);
```

10.0.20 matrix_rank

`matrix_rank(`*M*`)`
: It returns the rank of the matrix *M*.

Example:

```
matrix_rank([[1,1,1,1],[0,1,3,4]]);
```

10.0.21 matrix_rank_ff

`matrix_rank_ff(`*Mat*`,`*P*`)`
: It evaluates the rank of the matrix Mat by mod P. Entries may be rational numbers, and the inverse of the denominator D in F_P is properly computedd when P does not divide D, but the case P divides D does not raise an error.

10.0.22 matrix_row_matrix

`matrix_row_matrix(`*L*`)`
: It returns 1*n matrix [[L,L,...,L]] when L is a scalar. It returns 1*length(L) matrix [L].

`matrix_row_matrix(`*L* `|` *size*=*n*`=key0)`
: This function allows optional variables *size=n*

Example:

```
matrix_row_matrix(1 | size=5);
```

10.0.23 matrix_solve_linear

`matrix_solve_linear(`*M*`,`*X*`,`*B*`)`
: It solves the system of linear equations M X = B

Example:

```
matrix_solve_linear([[1,2],[0,1]],[x,y],[1,2]);
```

10.0.24 matrix_stack

`matrix_stack(`*A*`,`*B*`)`
: Stack the matrices A and B.

Example:

```
matrix_stack([[a11,a12],[a21,a22]],[[b11,b12],[b21,b22]]);
```

10.0.25 matrix_submatrix

`matrix_submatrix(`*M*`,`*Ind*`)`
: It returns the submatrix of M defined by the index set *Ind*.

Example:

```
matrix_submatrix([[0,1],[2,3],[4,5]],[1,2]);
```

10.0.26 matrix_transpose

`matrix_transpose(`*M*`)`
: It returns the transpose of the matrix M.

References:

`matrix_list_to_matrix`

11 Graphic(標準数学函数)

まだ書いてない.

12 表示(標準数学函数)

12.0.1 print_c_form

`print_c_form(`*S*`)`
: It transforms *S* to the C format or python format string.

Example 0:

```
print_c_form(x^2+1);
```

Example 1:

```
print_c_form(x^2+1 | mode=python);
```

Example 2:

```
print_c_form(sin(x^2+1)/5 | mode=c);
```

12.0.2 print_dvi_form

`print_dvi_form(`*S*`)`
: It outputs *S* to a dvi file.

Example:

```
print_dvi_form(x^2-1);
```

References:

`print_xdvi_form` , `print_tex_form`

12.0.3 print_em

`print_em(`*S*`)`
: It outputs *S* by a font to emphasize it.

Example:

```
print_em(x^2-1);
```

12.0.4 print_format

`print_format(`*S*`)`
: It changes the list format of S. Options are list, sep. Defaults are list=["",""], sep=",".

Example 0:

```
print_format([1,[x,y^2]]);
```

Example 1:

```
print_format([1,[x,y^2]] | list=["(",")"], sep=" ");
```

Example 2:

```
print_format(print_c_form([1,[x,y^2]]) );
```

12.0.5 print_gif_form

`print_gif_form(`*S*`)`
: It outputs *S* to a file of the gif format.

`print_gif_form(`*S* `|` *table*`=key0)`
: This function allows optional variables *table*

Example:

```
print_gif_form(newmat(2,2,[[x^2,x],[y^2-1,x/(x-1)]]));
```

References:

`print_tex_form`

12.0.6 print_input_form

`print_input_form(`*S*`)`
: It transforms *S* to a string which can be parsed by asir.

Example:

```
print_input_form(quote(x^3-1));
```

12.0.7 print_open_math_tfb_form

`print_open_math_tfb_form(`*S*`)`
: It transforms *S* to a tfb format of OpenMath XML.

Description:

It is experimental. You need to load taka_print_tfb.rr to call it.

Example:

```
print_open_math_tfb_form(quote(f(x,1/(y+1))+2));
```

12.0.8 print_open_math_xml_form

`print_open_math_xml_form(`*S*`)`
: It transforms *S* to a string which is compliant to OpenMath(1999).

Example:

```
print_open_math_xml_form(x^3-1);
```

References:

`www.openmath.org`

12.0.9 print_output

`print_output(`*Obj*`)`
: It outputs the object *Obj* to a file. If the optional variable *file* is set, then it outputs the *Obj* to the specified file, else it outputs it to "asir_output_tmp.txt". If the optional variable *mode* is set to "w", then the file is newly created. If the optional variable is not set, the *Obj* is appended to the file.

`print_output(`*Obj* `|` *file*`=key0,`*mode*`=key1)`
: This function allows optional variables *file*, *mode*

Example:

```
print_output("Hello"|file="test.txt");
```

References:

`glib_tops` , `( , )`

12.0.10 print_ox_rfc100_xml_form

`print_ox_rfc100_xml_form(`*S*`)`
: It transforms *S* to a string which is compliant to OpenXM RFC 100.

Example:

```
print_ox_rfc100_xml_form(x^3-1);
```

References:

`www.openxm.org`

12.0.11 print_pdf_form

`print_pdf_form(`*S*`)`
: It transforms *S* to a pdf file and previews the file.

Example 0:

```
print_pdf_form(newmat(2,2,[[x^2,x],[y^2-1,x/(x-1)]]));
```

Example 1:

```
print_pdf_form(poly_factor(x^10-1));
```

Optinal variabes: nopreview=1 does not preview the PDF file.

References:

`print_tex_form` , `print_xdvi_form`

12.0.12 print_png_form

`print_png_form(`*S*`)`
: It transforms *S* to a file of the format png. dvipng should be installed.

Example:

```
print_png_form(x^3-1);
```

References:

`print_tex_form`

12.0.13 print_terminal_form

`print_terminal_form(`*S*`)`
: It transforms *S* to the terminal form???

12.0.14 print_tex_form

`print_tex_form(`*S*`)`
: It transforms *S* to a string of the LaTeX format.

`print_tex_form(`*S* `| table=key0,raw=key1)`
: This function allows optional variables *table*, *raw*

Description:

The global variable Print_tex_form_fraction_format takes the values "auto", "frac", or "/". The global variable Print_tex_form_no_automatic_subscript takes the values 0 or 1. BUG; A large input S cannot be translated.

Example:

```
print_tex_form(x*dx+1 | table=[["dx","\\partial_x"]]);
```

The optional variable table is used to give a translation table of asir symbols and tex symbols. when AMSTeX = 1, "begin pmatrix" and "end pmatrix" will be used to output matrix.

References:

`print_xdvi_form`

12.0.15 print_tfb_form

`print_tfb_form(`*S*`)`
: It transforms *S* to the tfb format.

Example:

```
print_tfb_form(x+1);
```

12.0.16 print_xdvi_form

`print_xdvi_form(`*S*`)`
: It transforms *S* to a xdvi file and previews the file by xdvi.

Example 0:

```
print_xdvi_form(newmat(2,2,[[x^2,x],[y^2-1,x/(x-1)]]));
```

Example 1:

```
print_xdvi_form(print_tex_form(1/2) | texstr=1);
```

References:

`print_tex_form` , `print_dvi_form`

12.0.17 print_xv_form

`print_xv_form(`*S*`)`
: It transforms *S* to a gif file and previews the file by xv.

`print_xv_form(`*S* `| input=key0,format=key1)`
: This function allows optional variables *input*, *format*

Example 0:

```
print_xv_form(newmat(2,2,[[x^2,x],[y^2-1,x/(x-1)]]));
```

Example 1:

```
print_xv_form(x+y | format="png");
```

If the optional variable format="png" is set, png format will be used to generate an input for xv.

References:

`print_tex_form` , `print_gif_form`

13 多項式(標準数学函数)

13.0.1 poly_coefficient

poly_coefficient(*F*,*Deg*,*V*)
: It returns the coefficient of V^Deg in F. F may be rational or list or vector.

Example:

```
F=[(x+y+z)^10/z^2,(x-y+z)^10/z^3]$
poly_coefficient(F,10,x);
```

13.0.2 poly_coefficients_list

poly_coefficients_list(*F*,*V*)
: It returns the list of coefficients of F with respect to the variable list V. F may be rational or list or vector.

Example:

```
F=[(x+y+c*z)^2/c^2,(x-y+c*z)^2/c^3]$
poly_coefficients_list(F,[x,y,z]);
```

13.0.3 poly_coefficients_of_monomial_list

poly_coefficients_of_monomial_list(*F*,*VV*)
: It returns the list of coefficients of F with respect to a list of monomials VV.

Example:

```
poly_coefficients_of_monomial_list(2+3*x+4*z,[1,x,y,z]);
poly_coefficients_of_monomial_list((x+z)^3+5*y,[1,x,y,z,x^2*z]);
poly_coefficients_of_monomial_list([(x+y)^3,x+y],[x,x^2,x^3,x^2*y,x*y^2,y^3]);
```

References:

```
poly_construct_from_coefficients_of_monomial_list
```

13.0.4 poly_construct_from_coefficients_of_monomial_list

poly_construct_from_coefficients_of_monomial_list(*L*,*VV*)
: It returns the inner product of L and VV.

Example:

```
L=tk_poly_coefficients_of_monomial_list((x+y)^3,VV=[x,x^2,x^3,x^2*y,x*y^2,y^3]);
poly_construct_from_coefficients_of_monomial_list(L,VV);
```

References:

```
poly_coefficients_of_monomial_list
```

13.0.5 poly_dact

`poly_dact(Op,F,XL)`
: Act the differential operator Op to F. XL is a list of x variables.

Example:

```
poly_dact( x*dx+y*dy+a, x^(-3)*y^(-2), [x,y]);
```

13.0.6 poly_decompose_by_weight

`poly_decompose_by_weight(F,V,W)`
: decompose F into homogeneous components with respect to the variable V with the weight W. The return value is [[Max_ord,Min_ord],[component of Max_ord, ..., component of Min_ord]];

Example:

```
poly_decompose_by_weight(x^2*dx^2-x*(x*dx+y*dy+a),[x,y,dx,dy],[-1,-1,1,1]);
```

13.0.7 poly_degree

`poly_degree(F)`
: It returns the degree of F with respect to the given weight vector.

`poly_degree(F | weight=key0,v=key1)`
: This function allows optional variables *weight*, *v*

Description:

The weight is given by the optional variable weight w. It returns $\mathrm{ord}_w(F)$

Example:

```
poly_degree(x^2+y^2-4 |weight=[100,1],v=[x,y]);
```

13.0.8 poly_denominator

`poly_denominator(L)`
: It returns the denominator of L. L may be a list.

Example:

```
poly_denominator([1/(x^2-1),1/(x^3-1)]);
```

13.0.9 poly_diff2euler

`poly_diff2euler(Op,XL)`
: Express the differential operator Op by the euler operators. XL is a list of x variables. When XL=[x,y], dx,dy are differential operators and tx,ty are Euler operators (tx=x*dx, ty=y*dy). t stands for theta. When the return value is R, R[0]*R[1]=Op.

Example:

```
poly_diff2euler(dx^2-a*x,[x]);
```

13.0.10 poly_dmul

poly_dmul(*Op1*,*Op2*,*XL*)
: Multiply Op1 and Op2 in the Weyl algebra (the ring of differential operators). XL is a list of x variables.

Example:

```
poly_dmul( x*dx+y*dy+a*x, x*y*dx*dy, [x,y]);
```

13.0.11 poly_dvar

poly_dvar(*V*)
: Add d to the variable name *V*.

Example:

```
poly_dvar([x1,x2,x3]);
          poly_dvar([x1,x2,x3] | d=t);
```

13.0.12 poly_elimination_ideal

poly_elimination_ideal(*I*,*VV*)
: It computes the intersection of the ideal *I* and the subring K[*VV*].

poly_elimination_ideal(*I*,*VV* |
grobner_basis=key0,*gb*=key1,*v*=key2,*homo*=key3,*grace*=key4,*strategy*=key5)
: This function allows optional variables *grobner_basis*, *gb*, *v*, *homo*, *grace*, *strategy*

Description:

If grobner_basis is "yes" or gb=1, I is assumed to be a Grobner basis. The optional variable v is a list of variables which defines the ring of polynomials.

Example 0:

```
poly_elimination_ideal([x^2+y^2-4,x*y-1],[x]);
```

Example 1:

```
A = poly_grobner_basis([x^2+y^2-4,x*y-1]|order=2,v=[y,x]);
          poly_elimination_ideal(A,[x]|grobner_basis="yes");
When strategy=1(default),
  nd_gr is used when trace=0(defauult),
  nd_gr_trace is used when trace=1.
```

References:

gr , hgr , gr_mod , dp_*

13.0.13 poly_euler2diff

poly_euler2diff(*Op*,*XL*)
: Translate the differential operator Op expressed in terms of euler operators into the operators in terms of d. XL is a list of x variables. When XL=[x,y], dx,dy are differential operators and tx,ty are Euler operators (tx=x*dx, ty=y*dy). t stands for theta.

Example:

```
poly_euler2diff(tx^2-x*(tx+1/2)^2,[x]);
```

13.0.14 poly_expand

`poly_expand(F)`
: This is an alias of poly_sort.

References:

`poly_sort`

13.0.15 poly_factor

`poly_factor(F)`
: It factorizes the polynomial F.

Example:

```
poly_factor(x^10-y^10);
```

13.0.16 poly_gcd

`poly_gcd(F,G)`
: It computes the polynomial GCD of F and G.

Example:

```
poly_gcd(x^10-y^10,x^25-y^25);
```

13.0.17 poly_gr_w

`poly_gr_w(F,V,W)`
: It returns the Grobner basis of F for the weight vector W. It is the second interface for poly_grobner_basis.

Example:

```
poly_gr_w([x^2+y^2-1,x*y-1],[x,y],[1,0]);
```

References:

`poly_in_w` , `poly_grobner_basis`

13.0.18 poly_grobner_basis

`poly_grobner_basis(I)`
: It returns the Grobner basis of I.

`poly_grobner_basis(I | order=key0,v=key1)`
: This function allows optional variables *order*, *v*

Description:

The optional variable v is a list of variables which defines the ring of polynomials. Other Options; p (characteristic), homo, method (nd_gr_trace(default), nd_gr, nd_weyl_gr, nd_weyl_gr_trace, nd_f4, nd_f4_trace), order_matrix, order. See also asir manual. alias; poly_groebner_basis

Example:

```
A = poly_grobner_basis([x^2+y^2-4,x*y-1]|order=2,v=[y,x],str=1);
      A->Generators;
```

```
A->Ring->Variables;
A->Ring->Order;
B = poly_grobner_basis([x^2+y^2-4,x*y-1]|order=[[10,1]],v=[y,x]);
C = poly_grobner_basis([x^2+y^2-4,x*y-1]|order=[block,[0,1],[0,1]],v=[y,x]);
```

13.0.19 poly_hilbert_polynomial

poly_hilbert_polynomial(*I*)
: It returns the Hilbert polynomial of the poly_init(I).

poly_hilbert_polynomial(*I* | *s*=key0,*v*=key1,*sm1*=key2)
: This function allows optional variables *s*, *v*, *sm1*

Description:

The optional variable v is a list of variables. sm1=1 forces to call sm1. [sum(H(k),k,0,h), H(h)] where H(h) is the number of degree h monomials when h>>0. On asir2018, it returns [sum(H(k),k,0,h), H(h),[H[0],H[1],...],F,d] where F/(1-h)^d is the Poincare series.

Example:

```
poly_hilbert_polynomial([x1*y1,x1*y2,x2*y1,x2*y2]|s=k,v=[x1,x2,y1,y2]);
```

13.0.20 poly_ideal_colon

poly_ideal_colon(*I*,*J*,*V*)
: It computes the colon ideal of I by J V is the list of variables.

Example:

```
B=[(x+y+z)^50,(x-y+z)^50]$
V=[x,y,z]$
B=poly_ideal_colon(B,[(x+y+z)^49,(x-y+z)^49],V);
```

13.0.21 poly_ideal_intersection

poly_ideal_intersection(*I*,*J*,*V*,*Ord*)
: It computes the intersection of the ideal I and J V is the list of variables. *Ord* is the order.

Example:

```
A=[j*h*g*f*e*d*b,j*i*g*d*c*b,j*i*h*g*d*b,j*i*h*e*b,i*e*c*b,z]$
B=[a*d-j*c,b*c,d*e-f*g*h]$
V=[a,b,c,d,e,f,g,h,i,j,z]$
poly_ideal_intersection(A,B,V,0);
```

13.0.22 poly_ideal_saturation

poly_ideal_saturation(*I*,*J*,*V*)
: It computes the saturation ideal of I by J. V is the list of variables.

Example:

```
B=[(x+y+z)^50,(x-y+z)^50]$
V=[x,y,z]$
B=poly_ideal_saturation(B,[(x+y+z)^49,(x-y+z)^49],V);
```

13.0.23 poly_in

poly_in(*I*)
: It is an alias of poly_initial().

poly_in(*I* | *order*=key0,*v*=key1)
: This function allows optional variables *order*, *v*

Example:

```
poly_in([x^2+y^2-4,x*y-1]|order=0,v=[x,y]);
        poly_in([x^2+y^2-4,x*y-1]|order=[1,0],v=[x,y]);
```

13.0.24 poly_in_w

poly_in_w(*F*,*V*,*W*)
: It returns the initial term or the initial ideal in_w(F) for the weight vector given by order. F is s single polynomial or a list of polynomials.

poly_in_w(*F*,*V*,*W* | *gb*=key0)
: This function allows optional variables *gb*

Example:

```
poly_in_w([x^2+y^2-1,x*y-x] , [x,y], [1,0]);
```

References:

poly_weight_to_omatrix , poly_grobner_basis , poly_gr_w , poly_in_w_

13.0.25 poly_in_w_

poly_in_w_(*F*)
: It returns the initial term or the initial ideal in_w(F) for the weight vector given by order. F is s single polynomial or a list of polynomials. This is a new interface of poly_in_w with shorter args.

poly_in_w_(*F* | *v*=key0,*weight*=key1,*gb*=key2)
: This function allows optional variables *v*, *weight*, *gb*

Example:

```
poly_in_w_([x^2+y^2-1,x*y-x] | v=[x,y],weight=[1,0]);
```

References:

poly_weight_to_omatrix , poly_grobner_basis , poly_gr_w

13.0.26 poly_initial

`poly_initial(`*I*`)`
: It returns the initial ideal of I with respect to the given order.

`poly_initial(`*I* `|` *order*`=key0,`*v*`=key1)`
: This function allows optional variables *order*, *v*

Description:

The optional variable v is a list of variables. This function computes $\mathrm{in}_{\prec}(I)$

Example:

```
poly_initial([x^2+y^2-4,x*y-1]|order=0,v=[x,y]);
   poly_initial([x^2+y^2-4,x*y-1]|order=0,v=[x,y],gb=1);
   poly_in([x^2+y^2-4,x*y-1]|order=[1,0],v=[x,y]);
```

13.0.27 poly_initial_coefficients

`poly_initial_coefficients(`*I*`)`
: It computes the coefficients of the initial ideal of I with respect to the given order.

`poly_initial_coefficients(`*I* `|` *order*`=key0,`*v*`=key1)`
: This function allows optional variables *order*, *v*

Description:

The optional variable v is a list of variables. The order is specified by the optional variable order

Example:

```
poly_initial_coefficients([x^2+y^2-4,x*y-1]|order=0,v=[x,y]);
```

13.0.28 poly_initial_term

`poly_initial_term(`*F*`)`
: It returns the initial term of a polynomial F with respect to the given weight vector.

`poly_initial_term(`*F* `|` *weight*`=key0,`*order*`=key1,`*v*`=key2)`
: This function allows optional variables *weight*, *order*, *v*

Description:

The weight is given by the optional variable weight w. It returns $\mathrm{in}_w(F)$

Example:

```
poly_initial_term( x^2+y^2-4 |weight=[100,1],v=[x,y]);
```

13.0.29 poly_lcm

`poly_lcm(`*L*`)`
: It returns the LCM of L[0], L[1], ...

Example:

```
poly_lcm([x^2-1,x^3-1]);
```

13.0.30 poly_numerator

poly_numerator(*L*)
: It returns the numerator of L. L may be a list.

Example:

```
poly_numerator([1/(x^2-1),1/(x^3-1)]);
```

13.0.31 poly_ord_w

poly_ord_w(*F*,*V*,*W*)
: It returns the order with respect to W of F.

Example:

```
poly_ord_w(x^2+y^2-1,[x,y],[1,3]);
```

References:

poly_in_w

13.0.32 poly_prime_dec

poly_prime_dec(*I*,*V*)
: It computes the prime ideal decomposition of the radical of I. *V* is a list of variables.

Example:

```
B=[x00*x11-x01*x10,x01*x12-x02*x11,x02*x13-x03*x12,x03*x14-x04*x13,
        -x11*x20+x21*x10,-x21*x12+x22*x11,-x22*x13+x23*x12,-x23*x14+x24*x13];
        V=[x00,x01,x02,x03,x04,x10,x11,x12,x13,x14,x20,x21,x22,x23,x24];
        poly_prime_dec(B,V | radical=1);
```

13.0.33 poly_r_omatrix

poly_r_omatrix(*N*)
: It gives a weight matrix, which is used to compute a Grobner basis in K(x)<dx>, |x|=|dx|=N.

Example:

```
poly_r_omatrix(3);
When the option lex is given, the last lex variables are
compared firstly by the lexicographic order, e.g.,
poly_r_omatrix(4 | lex=2) is compared by the matrix
 0 0 0 0   0 0 0 1
 0 0 0 0   0 0 1 0
 0 0 0 0   1 1 0 0
 ....
```

References:

poly_weight_to_omatrix

13.0.34 poly_replace_factor

poly_replace_factor(*F*,*Rule*)
: It factorizes F and replaces factors by the Rule.

Example:

```
poly_replace_factor(2*x/((x-y)^3*y), [[x-y,s]]);
  It returns 2*x/(s^3*y).
```

13.0.35 poly_solve_linear

poly_solve_linear(*Eqs*,*V*)
: It solves the system of linear equations *Eqs* with respect to the set of variables *V*. When the option p=P is given, it solves the system by mod P. When the option reverse=1 is given, the lex order of reverse(V) is used.

Example:

```
poly_solve_linear([2*x+3*y-z-2, x+y+z-1], [x,y,z]);
          poly_solve_linear([2*x+3*y-z-2, x+y+z-1], [x,y,z] | p=13);
```

13.0.36 poly_sort

poly_sort(*F*)
: It expands *F* with a given variables *v*=V and a given weight *w*=W. It returns a quote object. If *truncate* option is set, the expansion is truncated at the given degree.

poly_sort(*F* | *v*=key0,*w*=key1,*truncate*=key2)
: This function allows optional variables *v*, *w*, *truncate*

Example:

```
poly_sort((x-y-a)^3 | v=[x,y], w=[-1,-1])
   returns a series expansion in terms of x and y.
```

13.0.37 poly_subsetq

poly_subsetq(*II*,*JJ*,*V*)
: If the ideal II is contained in the ideal JJ, it returns 1, else 0.

Example:

```
poly_subsetq([x^2-1,(x-1)*(y-2)],[x-1,y-2],[x,y]);
```

Optinal variabes: gb=1 (if JJ is already a GB). verbose=1 Note that when gb=1, the order must not be changed since the GB of JJ was computed. Otherwise, this function does not give correct answer or stucks. If gb=1 is not given, dp_ord(0) is executed in this function.

13.0.38 poly_toric_ideal

poly_toric_ideal(*A*,*V*)
: It returns generators of the affine toric ideal defined by the matrix(list) A. V is the list of variables.

Example:

```
poly_toric_ideal([[1,1,1,1],[0,1,2,3]],base_var_list(x,0,3));
```

Optinal variabes: nk_toric=1 (disable 4ti2)

13.0.39 poly_w_marking

`poly_w_marking(`*`Id`*`,`*`V`*`,`*`W`*`)`

: The monomials x^a in Id is rewritten to x^a*t_w^(<a,w>+b). <a,w> is the inner product and b is an integer to avoid negative powers of t_w. Return value is [w-marked polynomial, b]

Example:

```
poly_w_marking(x*dx^2+y*dy+a,[x,y,dx,dy],[-1,-1,1,1]);
  [t_w*x*dx^2+y*dy+a,0]
```

Optinal variabes: specify a name of homogenization variable by the option hvar. The default is t_w.

13.0.40 poly_weight_to_omatrix

`poly_weight_to_omatrix(`*`W`*`,`*`V`*`)`

: [obsoleted] It translates the weight vector W into a matrix, which is used to set the order in asir Grobner basis functions. V is the list of variables.

Example:

```
M=poly_weight_to_omatrix([2,1,0],[x,y,z]);
         nd_gr([x^3+z^3-1,x*y*z-1,y^2+z^2-1,[x,y,z],0,M);
```

13.0.41 poly_weight_to_ord_matrix

`poly_weight_to_ord_matrix(`*`W`*`)`

: Weight vector W is transformed to a matrix defined order for dp_ord, nd_gr, ... It is a new version of poly_weight_to_omatrix(W,V) [obsoleted]

Example:

```
Mat=poly_weight_to_ord_matrix([1,1,1,1,0,1,1,1,1,0]);
Mat=poly_weight_to_ord_matrix([]|tie_breaker=[lex,0,1,2,3,5,6,7,8,4,9]);
```

Optinal variabes: tie_breaker=[lex,n1,n2,n3,...] defines the lexcographic order x_n1,x_n2, x_n3, ... when variables are x_*

13.0.42 poly_weyl_subsetq

`poly_weyl_subsetq(`*`II`*`,`*`JJ`*`,`*`V`*`)`

: If the ideal II in the Weyl algebra is contained in the ideal JJ, it returns 1, else 0.

Example:

```
poly_weyl_subsetq([x*dx^2],[x*dx-1],[x,dx]);
```

Optinal variabes: gb=1 (if JJ is already a GB). verbose=1. Note that when gb=1, the order must not be changed since the GB of JJ was computed. Otherwise, this function does not give correct answer or stucks. If gb=1 is not given, dp_ord(0) is executed in this function.

14 複体(標準数学函数)

15 グラフィックライブラリ(2 次元)

16 Graphic Library (2 dimensional)

ライブラリ glib は, Risa/Asir のグラフィック基本関数(draw_obj) に対する, 昔の BASIC のような単純なインタフェースを提供する.

16.0.1 glib_clear

`glib_clear()`
: Clear the screen.

16.0.2 glib_flush

`glib_flush()`
: ; Flush the output. (Cfep only. It also set initGL to 1.).

16.0.3 glib_line

`glib_line(`*X0*`,`*Y0*`,`*X1*`,`*Y1*`)`
: It draws the line [*X0*,*Y0*]– [*X1*,*Y1*] with *color* and *shape*

`glib_line(`*X0*`,`*Y0*`,`*X1*`,`*Y1* `| `*color*`=key0,`*shape*`=key1)`
: This function allows optional variables *color*, *shape*

Example:

```
glib_line(0,0,5,3/2 | color=0xff00ff);
          glib_line(0,0,10,0 | shape=arrow);
```

16.0.4 glib_open

`glib_open()`
: It starts the ox_plot server and opens a canvas. The canvas size is set to *Glib_canvas_x* X *Glib_canvas_y* (the default value is 400). This function is automatically called when the user calls glib functions.

16.0.5 glib_plot

`glib_plot(`*F*`)`
: It plots an object F on the glib canvas.

Example 0:

```
glib_plot([[0,1],[0.1,0.9],[0.2,0.7],[0.3,0.5],[0.4,0.8]]);
```

Example 1:

```
glib_plot(tan(x));
```

16.0.6 glib_print

`glib_print(`*X*`,`*Y*`,`*Text*`)`
: It put a string *Text* at $[X,Y]$ on the glib canvas.

`glib_print(`*X*`,`*Y*`,`*Text* `| `*color*`=key0)`
: This function allows optional variables *color*

Example:

```
glib_print(100,100,"Hello Worlds" | color=0xff0000);
```

16.0.7 glib_ps_form

`glib_ps_form(`*S*`)`
: It returns the PS code generated by executing S (experimental).

Example 0:

```
glib_ps_form(quote( glib_line(0,0,100,100) ));
```

Example 1:

```
glib_ps_form(quote([glib_line(0,0,100,100),glib_line(100,0,0,100)]));
```

References:

`glib_tops`

16.0.8 glib_putpixel

`glib_putpixel(`*X*`,`*Y*`)`
: It puts a pixel at $[X,Y]$ with *color*

`glib_putpixel(`*X*`,`*Y*` | `*color*`=key0)`
: This function allows optional variables *color*

Example:

```
glib_putpixel(1,2 | color=0xffff00);
```

16.0.9 glib_remove_last

`glib_remove_last()`
: Remove the last object. glib_flush() should also be called to remove the last object. (cfep only).

16.0.10 glib_set_pixel_size

`glib_set_pixel_size(`*P*`)`
: Set the size of putpixel to P. 1.0 is the default. (cfep only).

16.0.11 glib_tops

`glib_tops()`
: If Glib_ps is set to 1, it returns a postscript program to draw the picture on the canvas.

References:

`print_output`

16.0.12 glib_window

`glib_window(`*Xmin*`,`*Ymin*`,`*Xmax*`,`*Ymax*`)`
: It generates a window with the left top corner $[Xmin,Ymin]$ and the right bottom corner $[Xmax,Ymax]$. If the global variable *Glib_math_coordinate* is set to 1, mathematical coordinate system will be employed, i.e., the left top corner will have the coordinate $[Xmin,Ymax]$.

Example:

```
glib_window(-1,-1,10,10);
```

17 OpenXM-Contrib 一般函数

17.1 函数一覧

17.1.1 ox_check_errors2

ox_check_errors2(*p*)
:: 識別番号p のサーバのスタック上にあるエラーオブジェクトをリストで戻す.

return リスト

p 数

- 識別番号p のサーバのスタック上にあるエラーオブジェクトをリストで戻す.
- エラーオブジェクトのポップはしない.

```
[219] P=sm1.start();
0
[220] sm1.sm1(P," 0 get ");
0
[221] ox_check_errors2(P);
[error([7,4294967295,executeString: Usage:get])]
Error on the server of the process number = 1
To clean the stack of the ox server,
type in ox_pops(P,N) (P: process number, N: the number of data you need to pop)
out of the debug mode.
If you like to automatically clean data on the server stack,
set XM_debug=0;
```

18 OXshell の関数

OXshell はシステムのコマンドを ox server より実行する仕組みである. 詳しくは OpenXM/src/kan96xx/Doc/oxshell.oxw および OpenXM/doc/Papers/rims-2003-12-16-ja.tex を見よ.

18.0.1 oxshell.get_value

`oxshell.get_value(`*NAME*`,`*V*`)`
: It get the value of the variable *NAME* on the server ox_shell.

Example:

```
oxshell.set_value("abc","Hello world!");
          oxshell.oxshell(["cp", "stringIn://abc", "stringOut://result"]);
          oxshell.get_value("result");
  What we do is a file $TMP/abc* is generated with the contents Hello world! and copi
  The contents of the file is stored in the variable result on ox_sm1.
```

References:

`oxshell.oxshell` , `oxshell.set_value`

18.0.2 oxshell.oxshell

`oxshell.oxshell(`*L*`)`
: It executes command *L* on a ox_shell server. *L* must be an array. The result is the outputs to stdout and stderr. A temporary file will be generated under $TMP. cf. oxshell.keep_tmp()

Example:

```
oxshell.oxshell(["ls"]);
```

References:

`ox_shell` , `oxshell.set_value` , `oxshell.get_value` , `oxshell` , `of` , `sm1.`

18.0.3 oxshell.set_value

`oxshell.set_value(`*NAME*`,`*V*`)`
: It set the value *V* to the variable *Name* on the server ox_shell.

Example:

```
oxshell.set_value("abc","Hello world!");
          oxshell.oxshell(["cat", "stringIn://abc"]);
```

References:

`oxshell.oxshell` , `oxshell.get_value`

19 Asir システム管理関数

19.0.1 asir_contrib_update

`asir_contrib_update()`
: It updates the asir-contrib library and/or some other files to the HEAD branch. The usage will be shown by asir_contrib_update() without the option update. Options are update, clean, url, install_dir, zip_files, tmp. Default values update=0, clean=0, url="http://www.math.kobe-u.ac.jp/OpenXM/Current", install_dir=%APPDATA%/OpenXM (win) or install_dir=$OpenXM_tmp/OpenXM (others) zip_files=["lib-asir-contrib.zip"]

Example:

```
asir_contrib_update();
asir_contrib_update(|update=1);    update the library
asir_contrib_update(|update=3);    update the library and the documents
asir_contrib_update(|clean=1);
asir_contrib_update(|zip_files=["lib-asir-contrib.zip","doc-asir2000.zip","doc-asir
```

20 便利な関数

システムの資源にアクセスするためおよび文字列処理の便利な関数を集めてある.

20.0.1 util_damepathq

`util_damepathq(`*S*`)`
: When *S* is a string by the ShiftJIS code and *S* contains dame-moji with respect to \, it returns [a non-zero number, the string].

Example:

```
T = [0x5c,0xe4,0x5c,0x41,0x42]$
T2=asciitostr(T)$
util_damepathq(T2);
```

20.0.2 util_file_exists

`util_file_exists(`*Fname*`)`
: It returns 1 when *Fname* exists. It returns 0 when *Fname* does not exist.

20.0.3 util_filter

`util_filter(`*Command*`,`*Input*`)`
: It executes the filter program *Command* with the *Input* and returns the output of the filter as a string.

`util_filter(`*Command*`,`*Input*` | `*env*`=key0)`
: This function allows optional variables *env*

Example:

```
util_filter("sort","cat\ndog\ncentipede\n");
```

20.0.4 util_find_and_replace

`util_find_and_replace(`*W*`,`*S*`,`*Wnew*`)`
: It replaces *W* in *S* by *Wnew*. Arguments must be lists of ascii codes or strings.

20.0.5 util_find_start

`util_find_start()`
: It tries to find the gnome-open command or an installed browser in unix systems. It returns "open" on MacOS X and returns "start" on Windows.

`util_find_start( | `*browser*`=key0)`
: This function allows optional variables *browser*

20.0.6 util_find_substr

`util_find_substr(`*W*`,`*S*`)`
: It returns the position of *W* in *S*. If *W* cannot be found, it returns -1. Arguments must be lists of ascii codes or strings.

20.0.7 util_index

`util_index(V)`
: It returns the name part and the index part of V.

Example:

```
util_index(x_2_3)
```

References:

`util_v`

20.0.8 util_load_file_as_a_string

`util_load_file_as_a_string(F)`
: It reads a file F as a string.

20.0.9 util_part

`util_part(S,P,Q)`
: It returns from Pth element to Qth element of S.

20.0.10 util_read_file_as_a_string

`util_read_file_as_a_string(F)`
: It reads a file F as a string.

20.0.11 util_remove_cr

`util_remove_cr(S)`
: It removes cr/lf/tabs from S. Arguments must be a list of ascii codes.

20.0.12 util_timing

`util_timing(Q)`
: Show the timing data to execute Q.

Example:

```
util_timing( quote( fctr(x^50-y^50) ));
```

20.0.13 util_v

`util_v(V,L)`
: It returns a variable indexed by L.

Example:

```
util_v("x",[1,3]);
```

References:

`util_index`

20.0.14 util_write_string_to_a_file

`util_write_string_to_a_file(Fname,S)`
: It writes a string S to a file *Fname*.

21 その他のマニュアル

この節では asir-contrib のその他のマニュアルを紹介する.

それからまだ分類がおわっていない関数を解説する. これらの関数は将来は別の独立した節へ移す予定である.

21.0.1 dsolv (Solving the initial ideal for holonomic systems)

../dsolv-html/dsolv-ja.html

21.0.2 gtt_ekn (Two way contingency tables by HGM)

../gtt_ekn-html/gtt_ekn-ja.html

21.0.3 f_res (Comuting resultant)

../f_res-html/f_res-ja.html

21.0.4 (gnuplot ox server for graphics)

../gnuplot-html/gnuplot-ja.html

21.0.5 mathematica (Mathematica (TM) ox server)

../mathematica-html/mathematica-ja.html

21.0.6 mt_graph (3D grapher)

../mk_graph-html/mk_graph-ja.html

21.0.7 mt_gkz (Intersection matrix of GKZ systems, English)

../mt_gkz-html/mt_gkz-ja.html

21.0.8 mt_mm (Macaulay matrix method)

../mt_mm-html/mt_mm-ja.html

21.0.9 n_wishartd (restriction of matrix 1F1)

../n_wishartd-html/n_wishartd-ja.html

21.0.10 nn_ndbf (local b-function)

../nn_ndbf-html/nn_ndbf-ja.html

21.0.11 noro_mwl (Mordel Weil Lattice)

../noro_mwl-html/noro_mwl-ja.html

21.0.12 noro_pd (New Primary Ideal Decomposition)

../noro_pd-html/noro_pd-ja.html

21.0.13 noro_module_syz (syzygies for modules)

../noro_module_syz-html/noro_module_syz-ja.html

21.0.14 ns_twistedlog (twisted logarithmic cohomology group)

../ns_twistedlog-html/ns_twistedlog-ja.html

21.0.15 nk_fb_gen_c (Fisher Bingham MLE)

../nk_fb_gen_c-html/nk_fb_gen_c-ja.html

21.0.16 ok_diff (Okutani's library for differential operators)

../ok_diff-html/ok_diff-ja.html

21.0.17 ok_dmodule (Okutani's library for D-modules)

../ok_dmodule-html/ok_dmodule-ja.html

21.0.18 om (om (java) ox server for translating CMO and OpenMath)

../om-html/om-ja.html

21.0.19 ox_pari (OpenXM pari server)

../ox_pari-html/ox_pari-ja.html

21.0.20 (Plucker relations)

../plucker-html/plucker-ja.html

21.0.21 pfpcoh (Ohara's library for homology/cohomology groups for p F q)

../pfpcoh-html/pfpcoh-ja.html

21.0.22 phc (PHC ox server for solving systems of algebraic equations by the homotopy method)

../phc-html/phc-ja.html

21.0.23 sm1 (Kan/sm1 ox server for the ring of differential operators)

../sm1-html/sm1-ja.html

21.0.24 tigers (tigers ox server for toric universal Grobner bases)

../tigers-html/tigers-ja.html

21.0.25 tk_ode_by_mpfr (Generating C codes for numerical analysis of ODE by MPFR)

../tk_ode_by_mpfr-html/tk_ode_by_mpfr-ja.html

21.0.26 todo_parametrize

../todo_parametrize-html/todo_parametrize-ja.html

パッケージtodo_parametrize/todo_parametrize.rr をロードすることにより, 有理曲線のパラメータ表示を見付ける関数である, paramerize が利用できるようになる. 詳しくはSee Section “概要” in *Risa/Asir* **代数曲線論用パッケージ説明書** を見よ(Web 版 Risa/Asir 代数曲線論用パッケージ説明書 (http://www.math.kobe-u.ac.jp/OpenXM/Current/doc/asir-contrib/html-ja/todo_parametrize/todo_parametrize_ja_toc.html)). このパッケージのマニュアルへの統合はまだできていない. このパッケージはまだ module 構造を利用していないので, 既存のライブラリと名前の衝突の可能性がある.

```
[1205] load("todo_parametrize/todo_parametrize.rr");
1
[1425] parametrize(y^2-x^3);
[155*t^2+20*t+1,720*t^4+1044*t^3+580*t^2,155*t^4+20*t^3+t^2,(-x)/(y)]
[1426] parametrize(y^2+x^3);
[-t,1,t^3,(-x)/(y)]
```

21.0.27 taji_alc

../taji_alc-html/taji_alc-ja.html

パッケージtaji_alc.rr をロードすることにより, 一変数代数的コホモロジ群に関連する関数をロードできる. (Web 版 Risa/Asir 一変数代数的局所コホモロジー類に関する Risa/Aisr パッケージ説明書 (http://www.math.kobe-u.ac.jp/OpenXM/Current/doc/asir-contrib/ja/taji_alc-html/taji_alc-ja_toc.html)).

```
import("taji_alc.rr");
taji_alc.laurent_expansion(x,(x-1)^3);
```

21.0.28 Texinfo でないマニュアル, 論文等.

OpenXM documents (http://www.math.kobe-u.ac.jp/OpenXM/Current/doc/index-doc-ja.html). には texinfo で書かれていない asir-contrib のファイルや関数のマニュアル, および関連論文へのリンクがある.

(yang, fj_curve, nk_mora 等)

索引

（インデックスがありません）

（インデックスがありません）

簡単な目次

目次