

$Pfpcoh$ (cohomology/homology groups for $p \leq q$)

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1 Cohomology group associated to pF_q

This section describes functions to evaluate invariants associated to (co)homology groups of the hypergeometric functions pF_q (${}_pF_q$)

In order to use the functions in this section in OpenXM/Risa/Asir, executing the commands

```
load("pfpcoh.rr")$ load("pfphom.rr")$
```

is necessary at first.

1.0.1 pfp_omega

`pfp_omega(P)`

: It returns the Gauss-Manin connection Ω for the generalized hypergeometric function ${}_pF_{p-1}(a_1, a_2, \dots; c_1, c_2, \dots; x)$.

Description:

Define a vector valued function Y of which elements are generalized hypergeometric function $f_1=F$ and $f_2=xd f_1/dx$, $f_3=xd f_2/dx$, ... It satisfies $dY/dx = \Omega Y$. Generalized hypergeometric function is defined by the series ${}_pF_{p-1}(a_1, a_2, \dots; c_1, c_2, \dots; x) = \sum_{k=0, \infty} (a_1)_k (a_2)_k \dots / (c_1)_k (c_2)_k \dots x^k$

Example:

```
pfp_omega(3);
```

1.0.2 pfpcoh_intersection

`pfpcoh_intersection(P)`

: `pfpcoh_intersection(P)` returns an intersection matrix for cocycles associated to the generalized hypergeometric function ${}_pF_{p-1}$.

Description:

This program `pfpcoh.rr` computes an intersection matrix S of cocycles of ${}_pF_{p-1}$ and compares it with the matrix obtained by solving a differential equation for intersection matrix.

Algorithm:

Ohara, Sugiki, Takayama, Quadratic Relations for Generalized Hypergeometric Functions ${}_pF_{p-1}$

Example:

```
load("pfpcoh.rr")$
S=pfpcoh_intersection(3);
```

Author : K.Ohara

1.0.3 pfphom_intersection

`pfphom_intersection(P)`
 : intersection matrix of homology cycles.

Description:

Computing intersection matrix of cycles associated to $p F_{(p-1)}$. As to the meaning of parameters c_1, c_2, c_3, \dots , see the paper Ohara, Kyushu J. Math. Vol. 51 PP.123.

Algorithm:

Ohara, Sugiki, Takayama, Quadratic Relations for Generalized Hypergeometric Functions $p F_{p-1}$

Example:

```
SS = pfphom_intersection(3)$
```

You get the intersection matrix of homologies for $3 F_2$.

Author : K.Ohara

1.0.4 pfphom_monodromy_pair_kyushu

`pfphom_monodromy_pair_kyushu(P)`
 :

Description:

It returns the pair of monodromy matrices.

Algorithm:

Ohara, Kyushu J. Math. Vol.51 PP.123 (1997)

Example:

```
MP = pfphom_monodromy_pair_kyushu(3)$
```

You get a pair of monodromy matrices for $3F_2$ standing for two paths encircling 0 and 1.

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