

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

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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 Omega for the generalized hypergeometric function  $P F P-1$  ( $aa_1, aa_2, \dots; cc_1, cc_2, \dots; x$ ).

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  $p F p-1(aa_1, aa_2, \dots; cc_1, cc_2, \dots; x) = \sum_{k=0, \infty} (aa_1)_k (aa_2)_k \dots / (1)_k (cc_1)_k (cc_2)_k \dots x^k$

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  $p F_{-(p-1)}$ .

Description:

This program `pfpcoh.rr` computes an intersection matrix  $S$  of cocycles of  $p F p-1$  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  $p F p-1$

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.

# Index

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(Index is nonexistent)

## Short Contents

1	Cohomology group associated to $pFq$ .....	1
	Index .....	3

# Table of Contents

<b>1</b>	<b>Cohomology group associated to <math>pFq</math>.....</b>	<b>1</b>
1.0.1	pf $\omega$ .....	1
1.0.2	pfcoh_intersection.....	1
1.0.3	pfphom_intersection.....	2
1.0.4	pfphom_monodromy_pair_kyushu.....	2
<b>Index</b> .....		<b>3</b>

