

Ok_diff (Okutani 緋 箆) ヲ

Edition : auto generated by oxgentexi on 8 June 2017

1 Differential equations (library by Okutani)

< や 'gr', 'ok_matrix.rr', 'ok_diff.rr' 緯苟 .

Yukio Okutani 繻 Risa/Asir 荐苾 吾 g 膩綵 緇 合縹 や . 鴻 医 odiff_障障.

換篁 違 小箵 鴻障 縹 ; 障障. 鴻 茵 障 障.

$$[[f_\alpha, [\alpha_1, \dots, \alpha_n]], \dots]$$

$$\sum_{\alpha} f_{\alpha} \partial^{\alpha}$$

渦 . 膩緇 合縹膾

$$(\sum_{\alpha^{(i)}} f_{\alpha^{(i)}} \partial^{\alpha^{(i)}}) \bullet u = 0 \quad (i = 1, \dots, s)$$

違 小箵 茵 障 小箵 鴻箵帥障.

$$[[[f_{\alpha^{(1)}}, [\alpha_1^{(1)}, \dots, \alpha_n^{(1)}]], \dots], \dots, [[f_{\alpha^{(s)}}, [\alpha_1^{(s)}, \dots, \alpha_n^{(s)}]], \dots]]$$

箴医小箵 $x\partial_x + y\partial_y + 1$ 翫

$$[[x, [1, 0]], [y, [0, 1]], [1, [0, 0]]]$$

障. 障緇 箵 鴻 $x\partial_x + y\partial_y + 1, \partial_x^2 + \partial_y^2$ 茵

$$[[[x, [1, 0]], [y, [0, 1]], [1, [0, 0]]], [[1, [2, 0]], [1, [0, 2]]]]$$

障. 障 ; 丈箵帥 違 鴻紹吾 荔 緯苟障. 罨< 縹 茵 障 や 唇鴻障. 紊 x 緇 dx ; 障障. 箴 $x\partial_x + y\partial_y + 1$ や

$$x * dx + y * dy + 1$$

; 障障.

1.0.1 odiff_op_appell4

odiff_op_appell4(a,b,c1,c2,V)
:: appell F_4 九緇 箵 障.

return 鴻

a, b, c1, c2
縹

V 鴻

• odiff_op_appell4 .

```
[298] odiff_op_appell4(a,b,c1,c2,[x,y]);
[ [ [-x^2+x,[2,0]], [-2*y*x,[1,1]], [-y^2,[0,2]],
  [(-a-b-1)*x+c1,[1,0]], [(-a-b-1)*y,[0,1]], [-b*a,[0,0]] ],
  [ [-y^2+y,[0,2]], [-2*y*x,[1,1]], [-x^2,[2,0]],
  [(-a-b-1)*y+c2,[0,1]], [(-a-b-1)*x,[1,0]], [-b*a,[0,0]] ] ]
```

1.0.2 odiff_op_tosm1

```

odiff_op_tosm1(LL,V)
    :: 鴻綵 小箆 鴻 sm1 綵 障.

return 鴻
LL      鴻
V        鴻
• 緇 箆 違 價医綵 障.
• odiff_op_tosm1
  [299] odiff_op_tosm1([[x,[2,0]],[-1,[0,0]]],
                      [[y,[0,2]],[-1,[0,0]]],[x,y]);
  [ + ( + (1) x) dx^2 + ( + (-1)), + ( + (1) y) dy^2 + ( + (-1))]

  [300] odiff_op_tosm1([[x,[1,0]], [y,[0,1]], [1,[0,0]]],
                      [[1,[2,0]], [1,[0,2]]],[x,y]);
  [ + ( + (1) x) dx + ( + (1) y) dy + ( + (1)), + ( + (1)) dx^2 + ( + (1)) dy^2]

  [301] odiff_op_tosm1([[1/2,[1,0]], [1,[0,0]]],
                      [[1/3,[0,1]], [1/4,[0,0]]],[x,y]);
  [ + ( + (6)) dx + ( + (12)), + ( + (4)) dy + ( + (3))]

  [302] odiff_op_tosm1([[1/2*x,[1,0]], [1,[0,0]]],
                      [[1/3*y,[0,1]], [1/4,[0,0]]],[x,y]);
  [ + ( + (6) x) dx + ( + (12)), + ( + (4) y) dy + ( + (3))]

```

1.0.3 odiff_op_toasir

```

odiff_op_toasir(LL,V)
    :: 鴻綵 小箆 鴻 LL asir 綵 障.

return 鴻
LL      鴻
V        鴻
• odiff_op_toasir
  [303] odiff_op_toasir([[1/2*x,[1,0]], [1,[0,0]]],
                      [[1/3*y,[0,1]], [1/4,[0,0]]],[x,y]);
  [1/2*x*dx+1,1/3*y*dy+1/4]

  [304] odiff_op_toasir([[x,[1,0]], [y,[0,1]], [1,[0,0]]],
                      [[1,[2,0]], [1,[0,2]]],[x,y]);
  [x*dx+y*dy+1,dx^2+dy^2]

```

1.0.4 odiff_op_fromasir

```

odiff_op_fromasir(D_list,V)
    :: asir 綵 鴻綵 小箆 鴻 障.

```

```

return      鴻
D_list      鴻
V           鴻
• odiff_op_fromasir
  [305] odiff_op_fromasir([1/2*x*dx+1,1/3*y*dy+1/4],[x,y]);
        [[[1/2*x,[1,0]], [1,[0,0]]], [[1/3*y,[0,1]], [1/4,[0,0]]]]

  [306] odiff_op_fromasir([x*dx+y*dy+1,dx^2+dy^2],[x,y]);
        [[[x,[1,0]], [y,[0,1]], [1,[0,0]]], [[1,[2,0]], [1,[0,2]]]]

```

1.0.5 odiff_act

```

odiff_act(L,F,V)
:: 緋 節 L 縹 F . V 違 鴻.

return      縹
L           鴻 or 系縹
F           縹
V           鴻
• odiff_act
  [302] odiff_act([[1,[2]]],x^3+x^2+x+1,[x]);
        6*x+2

  [303] odiff_act([[1,[1,0]], [1,[0,1]]],x^2+y^2,[x,y]);
        2*x+2*y

  [349] odiff_act(x*dx+y*dy, x^2+x*y+y^2, [x,y]);
        2*x^2+2*y*x+2*y^2

```

1.0.6 odiff_act_appell4

```

odiff_act_appell4(a,b,c1,c2,F,V)
:: 緋 節 odiff_op_appell4 縹 F .

return      鴻
a, b, c1, c2
           縹
F           縹
V           鴻
• odiff_act_appell4
  [303] odiff_act_appell4(1,0,1,1,x^2+y^2,[x,y]);
        [-6*x^2+4*x-6*y^2,-6*x^2-6*y^2+4*y]

  [304] odiff_act_appell4(0,0,1,1,x^2+y^2,[x,y]);

```

$$[-4*x^2+4*x-4*y^2,-4*x^2-4*y^2+4*y]$$

```
[305] odiff_act_appell14(-2,-2,-1,-1,x^2+y^2,[x,y]);
[0,0]
```

1.0.7 odiff_poly_solve

```
odiff_poly_solve(LL,N,V)
```

```
:: 箏膩緇 合綰膾祉 N 電>札箏 綰茹 c 罷.
```

```
return      鴻
```

```
LL          鴻
```

```
N          膾
```

```
V          鴻
```

- odiff_poly_solve .

```
[297] odiff_poly_solve([[x,[1,0]],[-1,[0,0]]],[[y,[0,1]],[-1,[0,0]]],5,[x,y]);
[_4*y*x,[_4]]
```

```
[298] odiff_poly_solve([[x,[1,0]],[-2,[0,0]]],[[y,[0,1]],[-2,[0,0]]],5,[x,y]);
[_33*y^2*x^2,[_33]]
```

```
[356] odiff_poly_solve([x*dx+y*dy-3,dx+dy],4,[x,y]);
[-_126*x^3+3*_126*y*x^2-3*_126*y^2*x+_126*y^3,[_126]]
```

1.0.8 odiff_poly_solve_hg1

```
odiff_poly_solve_hg1(a,b,c,V)
```

```
::      鴻 認鞘緇 合綰 綰茹 c 罷.
```

```
return      鴻
```

```
a, b, c     綰
```

```
V          鴻
```

- odiff_poly_solve_hg1 .

```
[334] odiff_poly_solve_hg1(-3,-6,-5,[x]);
[_1*x^6-2*_0*x^3+9/2*_0*x^2-18/5*_0*x+_0,[_0,_1]]
```

```
[335] odiff_poly_solve_hg1(-3,-6,-7,[x]);
[-4/7*_2*x^3+15/7*_2*x^2-18/7*_2*x+_2,[_2]]
```

1.0.9 odiff_poly_solve_appell14

```
odiff_poly_solve_appell14(a,b,c1,c2,V)
```

```
:: F_4 帥膩緇 合綰膾祉 綰茹 c 罷.
```

```
return      鴻
```

```
a, b, c1, c2
```

```
綰
```

V 鴻

- `odiff_poly_solve_appell4` .
 [299] `odiff_poly_solve_appell4(-3,1,-1,-1,[x,y]);`
 `[-_26*x^3+(3*_26*y+_26)*x^2+3*_24*y^2*x-_24*y^3+_24*y^2,[_24,_26]]`
 [300] `odiff_poly_solve_appell4(-3,1,1,-1,[x,y]);`
 `[-3*_45*y^2*x-_45*y^3+_45*y^2,[_45]]`

1.0.10 `odiff_rat_solve`

`odiff_rat_solve(LL,Dn,N,V)`
 :: 箏膩緇 合縹膾祉 罰 Dn , 紉 N 電 > 札箏 縹 𧢲.

return 鴻

LL 鴻

Dn 縹

N 𧢲

V 鴻

- `odiff_rat_solve` .
 [333] `odiff_rat_solve([[x,[1]],[1,[0]]],x,1,[x]);`
 `[(_8)/(x),[_8]]`
 [361] `odiff_rat_solve([x*(1-x)*dx^2+(1-3*x)*dx-1],1-x,2,[x]);`
 `[(_180)/(-x+1),[_180]]`
 [350] `D = odiff_op_appell4(0,0,3,0,[x,y])$`
 [351] `odiff_rat_solve(D,x^2,2,[x,y]);`
 `[(_118*x^2-_114*y*x+1/2*_114*y^2+_114*y)/(x^2),[_114,_118]]`

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(Index is nonexistent)

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