Ok_diff (Okutani)

1 Differential equations (library by Okutani)

gr, `ok_matrix.rr`, `ok_diff.rr` .

Yukio Okutani Risa/Asir . odiff_ .

. .

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

$$\sum_\alpha f_\alpha \partial^\alpha$$

.

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

.

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

$x\partial_x + y\partial_y + 1$

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

. $x\partial_x + y\partial_y + 1, \partial_x{}^2 + \partial_y{}^2$

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

. . . $xdx.$ $x\partial_x + y\partial_y + 1$

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

.

1.0.1 `odiff_op_appell4`

`odiff_op_appell4(a,b,c1,c2,V)`
          :: appell F_4 .

return

a, b, c1, c2

V

- `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)`
          :: sm1 .

return

LL

V

- .
- `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)`
          :: *LL* asir .

return

LL

V

- `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 .

return

D_list

V

- `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*`)`
          :: *L F . V .*

return

L   or

F

V

- `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*`)`
          :: `odiff_op_appell4` *F .*

return

a, b, c1, c2

F

V

- `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_appell4(-2,-2,-1,-1,x^2+y^2,[x,y]);
        [0,0]
```

1.0.7 odiff_poly_solve

odiff_poly_solve(*LL*,*N*,*V*)
            :: *N* .

return

LL

N

V

- 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*)
            :: .

return

a, b, c

V

- 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_appell4

odiff_poly_solve_appell4(*a*,*b*,*c1*,*c2*,*V*)
            :: F_4.

return

a, b, c1, c2

V

- `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*`)`
            ::   *Dn*, *N* .

return

LL

Dn

N

V

- `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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