

```
> restart:
```

```
with(PDEtools, casesplit, declare):
with(DEtools, gensys):
```

```
with(DifferentialGeometry):
```

```
with(JetCalculus):
with(LieAlgebras):
with(GroupActions):
```

```
DGsetup([x,y,z,u], Rquatre):      Repere_xyzu := evalDG([D_x,
D_y,D_z,D_u]);
```

```
FF := sort(expand(
```

```
x^2*z^5+y^2*z^5+x^2*z^4+y^2*z^4+x^2*z^3+y^2*z^3+x^2*z^2+y^2*z^2+
x^2*z+y^2*z+x^2+y^2
```

```
), [z,y,x], ascending);
```

$$Repere_xyzu := [\partial_x, \partial_y, \partial_z, \partial_u]$$

$$FF := x^2 + y^2 + zx^2 + zy^2 + z^2x^2 + z^2y^2 + z^3x^2 + z^3y^2 + z^4x^2 + z^4y^2 + z^5x^2 + z^5y^2 \quad (1)$$

```
> e[1] := evalDG(-(-1+z)*D_x+0*D_y+0*D_z+2*x*D_u);
```

```
e[2] := evalDG(0*D_x-(-1+z)*D_y+0*D_z+2*y*D_u);
```

```
e[3] := evalDG(0*D_x+0*D_y-(-1+z)*D_z+u*D_u);
```

```
e[4] := evalDG(x*D_x+y*D_y+0*D_z+2*u*D_u);
```

```
e[5] := evalDG(-y*D_x+x*D_y+0*D_z+0*D_u);
```

```
e[6] := evalDG(-(1/2)*u*D_x+0*D_y+x*D_z+0*D_u);
```

```
e[7] := evalDG(0*D_x-(1/2)*u*D_y+y*D_z+0*D_u);
```

$$e_1 := -(-1+z)\partial_x + 2x\partial_u$$

$$e_2 := -(-1+z)\partial_y + 2y\partial_u$$

$$e_3 := -(-1+z)\partial_z + u\partial_u$$

$$e_4 := x \partial_x + y \partial_y + 2 u \partial_u$$

$$e_5 := -y \partial_x + x \partial_y$$

$$e_6 := -\frac{u}{2} \partial_x + x \partial_z$$

$$e_7 := -\frac{u}{2} \partial_y + y \partial_z$$

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```
> algebre_lie := LieAlgebraData([seq(e[i], i=1..7)]);
```

```
  DGsetup(algebre_lie):
```

```
  LD := LeviDecomposition();
```

```
  resolvable := Query("Solvable");
```

```
  semi_simple := Query("Semisimple");
```

```
  MultiplicationTable("LieTable");
```

```
algebre_lie:= [e1, e2] = 0, [e1, e3] = e1, [e1, e4] = e1, [e1, e5] = e2, [e1, e6]
] = e3, [e1, e7] = -e5, [e2, e3] = e2, [e2, e4] = e2, [e2, e5] = -e1, [e2, e6]
] = e5, [e2, e7] = e3, [e3, e4] = 0, [e3, e5] = 0, [e3, e6] = e6, [e3, e7] = e7,
[e4, e5] = 0, [e4, e6] = e6, [e4, e7] = e7, [e5, e6] = -e7, [e5, e7] = e6, [e6, e7]
] = 0
```

```
LD:= [[e3-e4], [e1, e2, e3, e5, e6, e7]]
```

```
resolvable:= false
```

```
semi_simple:= false
```

| L1 | e1 | e2 | e3 | e4 | e5 | e6 | e7 |
|----|-----|-----|-----|-----|-----|-----|-----|
| e1 | 0 | 0 | e1 | e1 | e2 | e3 | -e5 |
| e2 | 0 | 0 | e2 | e2 | -e1 | e5 | e3 |
| e3 | -e1 | -e2 | 0 | 0 | 0 | e6 | e7 |
| e4 | -e1 | -e2 | 0 | 0 | 0 | e6 | e7 |
| e5 | -e2 | e1 | 0 | 0 | 0 | -e7 | e6 |
| e6 | -e3 | -e5 | -e6 | -e6 | e7 | 0 | 0 |
| e7 | e5 | -e3 | -e7 | -e7 | -e6 | 0 | 0 |

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