

```

[ > restart;
[ > with(PIR): with(Involutive): with(JanetOre): with(OreModules):
  with(Janet): with(homalg):
[ The package PIR:
[ > RPP:=`PIR/homalg`;
                                     RPP := PIR/homalg
[ > var:=[x];
                                     var := [x]
[ > Pvar(var);
                                     ["Q[x]", x]
[ > A:=matrix([[x^2+x, 0], [0, x^3]]);
                                     
$$A := \begin{bmatrix} x^2 + x & 0 \\ 0 & x^3 \end{bmatrix}$$

[ > MP:=Cokernel(A, var, RPP);
   MP := [[1, 0] = [-x^2 + 1, x^2], [0, 1] = [-1, 1], [[x, 0], [0, x^4 + x^3]], "Presentation", [x, x^4 + x^3], 0]
[ The package Involutive:
[ > RPI:=`Involutive/homalg`;
                                     RPI := Involutive/homalg
[ > MI:=Cokernel(A, var, RPI);
   MI := [[1, 0] = [1, 0], [0, 1] = [0, 1], [[x^2 + x, 0], [0, x^3]], "Presentation", 2 + 2 s + s^2, [0]]
[ The package JanetOre:
[ > RPO:=`JanetOre/homalg`;
                                     RPO := JanetOre/homalg
[ > Ore:=[[Dx, x], [], [weyl(Dx, x)]];
                                     Ore := [[Dx, x], [], [weyl(Dx, x)]]
[ > AO := matrix([[Dx^2+Dx, 0], [0, Dx^3]]);
                                     
$$AO := \begin{bmatrix} Dx^2 + Dx & 0 \\ 0 & Dx^3 \end{bmatrix}$$

[ > MO:=Cokernel(AO, Ore, RPO);
   MO := [[1, 0] = [1, 0], [0, 1] = [0, 1], [[Dx^2 + Dx, 0], [0, Dx^3]], "Presentation",
   
$$2 + 4 s + 5 s^2 + \frac{5 s^3}{1 - s}, [5, 0]]$$

[ The package OreModules:
[ > RPM:=`OreModules/homalg`;
                                     RPM := OreModules/homalg
[ > Alg:=DefineOreAlgebra(diff=[Dx, x], polynom=[x]);
   Alg := [Ore_algebra, ["diff"], [x], [Dx], [x], [], 0, [], [], [x], [], [], [diff = [Dx, x]]]

```

```
> MM:=Cokernel(AO,Alg,RPM);
```

```
MM:=
```

$$\left[[[1, 0]=[1, 0], [0, 1]=[0, 1]], [[Dx^2 + Dx, 0], [0, Dx^3]], \text{"Presentation"}, -\frac{1+s}{s-1} - \frac{s^2+s+1}{s-1} \right]$$

The pseudo-package OreModulesStafford:

```
> RPS := `OreModulesStafford/homalg`;
```

```
RPS := OreModulesStafford/homalg
```

```
> MS:=Cokernel(AO,Alg,RPS);
```

```
MS:=
```

$$\left[[[1, 0]=[1, 0], [0, 1]=[0, 1]], [[Dx^2 + Dx, 0], [0, Dx^3]], \text{"Presentation"}, -\frac{1+s}{s-1} - \frac{s^2+s+1}{s-1} \right]$$

The package Janet:

```
> RPJ:=`Janet/homalg`;
```

```
RPJ := Janet/homalg
```

```
> AA:=Pol2Op(A,var);
```

$$AA := \begin{bmatrix} [[1, [x, x]], [1, [x]]] & 0 \\ 0 & [[1, [x, x, x]]] \end{bmatrix}$$

```
> MG:=Cokernel(AA,var,RPJ);
```

```
MG := [[[[[1, [ ]], 0] = [[1, [ ]], 0], [0, [[1, [ ]]]] = [0, [[1, [ ]]]],
```

```
[[[[1, [x, x]], [1, [x]], 0], [0, [[1, [x, x, x]]]], "Presentation", 2 + 2 s + s^2, [0]]
```

```
> Pres2Diff(MG, var, [u,v], [u,v]);
```

$$\left[[u(x)=u(x), v(x)=v(x)], \left[\left(\frac{d^2}{dx^2} u(x) \right) + \left(\frac{d}{dx} u(x) \right) \frac{d^3}{dx^3} v(x) \right], \text{"Presentation"}, 2 + 2 s + s^2, [0] \right]$$

The pseudo-package Janet1:

```
> RPJ1:=`Janet1/homalg`;
```

```
RPJ1 := Janet1/homalg
```

```
> MJ:=Cokernel(AA,var,RPJ1);
```

$$MJ := \left[[[1, []]] = \left[\left[\left[-\frac{x}{-3+x}, [x, x] \right], \left[-\frac{3(-2+x)}{9-6x+x^2}, [x] \right], \left[\frac{x^3-9x^2+24x-24}{-27+27x-9x^2+x^3}, [1] \right] \right] \right],$$

$$\left[\left[\frac{1}{-3+x}, [x, x] \right], \left[\frac{1}{9-6x+x^2}, [x] \right], \left[\frac{2}{-27+27x-9x^2+x^3}, [1] \right] \right] \right], \left[[1, [x, x, x, x, x]],$$

$$\left[\frac{x+12}{-3+x}, [x, x, x, x] \right], \left[\frac{12(x+2)}{9-6x+x^2}, [x, x, x] \right], \left[\frac{12(3x-4)}{-27+27x-9x^2+x^3}, [x, x] \right],$$

$$\left[\frac{24}{-27+27x-9x^2+x^3}, [x] \right] \right], \text{"Presentation"}, 1 + s + s^2 + s^3 + s^4, [0]$$

```
> Pres2Diff(MJ, var, [u,v], [w]);
```


