```
# Maple sample file for J. ISCIE by K. Fujimoto  2011.03

# step 1
CodeGeneration[Matlab](arcsin(x));
cg = asin(x);

# step 2
diff(sin(x1^2 + x1·x2), x1);
```

$$\cos\left(x1^2 + x1\,x2\right)\,(2\,x1 + x2) \tag{1}$$

```
# step 3
with(VectorCalculus):
F := [tan(x2), u/cos(x2)]:
Jacobian(F, [x1, x2, u]);
```

$$\begin{bmatrix} 0 & 1+\tan(x2)^2 & 0 \\ 0 & \dfrac{u\sin(x2)}{\cos(x2)^2} & \dfrac{1}{\cos(x2)} \end{bmatrix} \tag{2}$$

```
# step 4
int(cos(x1^2 + x1·x2)·(2·x1 + x2), x1);
```

$$\sin\left(x1^2 + x1\,x2\right) \tag{3}$$

```
# step 5
g := [x2^2, 2·x1·x2]:
Jacobian(g, [x1, x2]);
```

$$\begin{bmatrix} 0 & 2\,x2 \\ 2\,x2 & 2\,x1 \end{bmatrix} \tag{4}$$

```
pdsolve([diff(f(x1, x2), x1) = g[1],
         diff(f(x1, x2), x2) = g[2]]);
```

$$\{f(x1, x2) = x2^2\,x1 + \_C1\} \tag{5}$$

```
# step 6
A := evalf(subs({x1 = 0, x2 = 0, u = 0}, Jacobian(F, [x1, x2])));
```

$$\begin{bmatrix} 0. & 1. \\ 0. & 0. \end{bmatrix} \tag{6}$$

```
B := evalf(subs({x1 = 0, x2 = 0, u = 0}, diff(F, u)));
```

$$[0., 1.] \tag{7}$$

```
# step 7
MyL := proc(phi, f, x, k)
 local i, result:
 with(VectorCalculus):
```

```
 result := phi :
 for i from 1 to k do
  result := evalm(Jacobian([result], x) &* f)[1] :
 end do:
 result;
end proc:
MyL(x1, F, [x1, x2], 2);
```

$$\frac{\left(1+\tan(x2)^2\right)u}{\cos(x2)} \tag{8}$$

```
# step 8
dsolve(-diff(V(x), x)·sinh(x) + x^2 = 0);
```

$$V(x) = x^2\ln\left(1-e^x\right) + 2x\,\mathrm{polylog}\left(2, e^x\right) - 2\,\mathrm{polylog}\left(3, e^x\right) - x^2\ln\left(1+e^x\right) - 2x\,\mathrm{polylog}\left(2, -e^x\right) + 2\,\mathrm{polylog}\left(3, -e^x\right) + \_C1 \tag{9}$$

```
# step 9
V4 := c1·x + c2·x^2 + c3·x^3 + c4·x^4 :
eq4 := mtaylor(-diff(V4, x)·sinh(x) + x^2, x, 5) :
match(0 = eq4, x, 'sol4') :
sol4;
```

$$\left\{c1 = 0,\ c2 = \frac{1}{2},\ c3 = 0,\ c4 = -\frac{1}{24}\right\} \tag{10}$$

```
# step 10
xx := [x1, x2] :
f := [tan(x2), 0] :
g := [0, 1/cos(x2)] :
h := x1 :
MyL(h, g, xx, 1);
```

$$0 \tag{11}$$

```
MyL(MyL(h, f, xx, 1), g, xx, 1);
```

$$\frac{1+\tan(x2)^2}{\cos(x2)} \tag{12}$$

```
# step 11
alpha := -MyL(h, f, xx, 2) / MyL(MyL(h, f, xx, 1), g, xx, 1);
```

$$0 \tag{13}$$

```
beta := 1 / MyL(MyL(h, f, xx, 1), g, xx, 1);
```

$$\frac{1}{MyL\left(\tan(x2), \left[0, \frac{1}{\cos(x2)}\right], [x1, x2], 1\right)} \tag{14}$$

```
Phi := [h, MyL(h, f, xx, 1)];
```

$$[x1, \tan(x2)] \tag{15}$$

```
# step 12
sol := pdsolve(evalm(Jacobian([phi(x1, x2)], xx) &* g)[1] = 0);
```

$$\phi(x1, x2) = \_F1(x1) \tag{16}$$

```
fg := evalm(Jacobian(g, xx) &* f - Jacobian(f, xx) &* g):
evalm(Jacobian([subs(sol, phi(x1, x2))], xx) &* fg)[1];
```

$$-\frac{\left(\frac{d}{dx1}\_F1(x1)\right)\left(1+\tan(x2)^2\right)}{\cos(x2)} \tag{17}$$

```
# step 13
P := [[3, -1], [-1, 1]]/2:
V := simplify(evalm(Phi &* P &* Phi));
```

$$\frac{3}{2}x1^2 - x1\tan(x2) + \frac{1}{2}\tan(x2)^2 \tag{18}$$

```
LgV := simplify(MyL(V, g, xx, 1)):
LfV := simplify(MyL(V, f, xx, 1)):
ux := -(LfV + sqrt(LfV^2 + LgV^4))/LgV;
```

$$\frac{1}{x1\cos(x2) - \sin(x2)}\left(\left(-(-3x1 + \tan(x2))\tan(x2) + \sqrt{(-3x1 + \tan(x2))^2\tan(x2)^2 + \frac{(x1\cos(x2) - \sin(x2))^4}{\cos(x2)^{16}}}\right)\cos(x2)^4\right) \tag{19}$$