

# Funzioni e loro uso



```
(%i1) depends(U, [x,y,z]);
(%o1) [U(x,y,z)]
```

```
(%i2) derivabbrev:true;
(%o2) true
```

```
(%i3) lgmia(a,x,y,z):= block( [r],r: a/(x*x+y*y+z*z),ratsimp(matrix (
[ 1/(1-a), 0,0,0 ],
[ 0,-1+r*x^2,r*x*y, r*x*z ],
[ 0,r*x*y,-1+r*y^2,r*y*z ],
[ 0,r*x*z,r*y*z,-1+r*z^2]))) ;
```

```
(%o3) lgmia(a,x,y,z):=
block( [r], r:  $\frac{a}{x^2+y^2+z^2}$ , ratsimp  $\begin{pmatrix} \frac{1}{1-a} & 0 & 0 & 0 \\ 0 & -1+rx^2 & rxy & rxz \\ 0 & rxy & -1+ry^2 & ryz \\ 0 & rxz & ryz & -1+rz^2 \end{pmatrix}$ )
```

```
(%i4) lg:lgmia(U,px,py,pz);
```

```
(%o4)  $\begin{pmatrix} \frac{1}{U-1} & 0 & 0 & 0 \\ 0 & \frac{px^2 U - pz^2 - py^2 - px^2}{pz^2 + py^2 + px^2} & \frac{px py U}{pz^2 + py^2 + px^2} & \frac{px pz U}{pz^2 + py^2 + px^2} \\ 0 & \frac{px py U}{pz^2 + py^2 + px^2} & \frac{py^2 U - pz^2 - py^2 - px^2}{pz^2 + py^2 + px^2} & \frac{py pz U}{pz^2 + py^2 + px^2} \\ 0 & \frac{px pz U}{pz^2 + py^2 + px^2} & \frac{py pz U}{pz^2 + py^2 + px^2} & \frac{pz^2 U - pz^2 - py^2 - px^2}{pz^2 + py^2 + px^2} \end{pmatrix}$ 
```

```
(%i5) ug:ratsimp(invert(lg));
```

```
(%o5)  $\begin{pmatrix} 1-U & 0 & 0 & 0 \\ 0 & \frac{(pz^2 + py^2) U - pz^2 - py^2 - px^2}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} & \frac{px py U}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} & \frac{px pz U}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} \\ 0 & \frac{px py U}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} & \frac{(pz^2 + px^2) U - pz^2 - py^2 - px^2}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} & \frac{py pz U}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} \\ 0 & \frac{px pz U}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} & \frac{py pz U}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} & \frac{(py^2 + px^2) U - pz^2 - py^2 - px^2}{(pz^2 + py^2 + px^2) U - pz^2 - py^2 - px^2} \end{pmatrix}$ 
```

```
(%i6) uug:ratsimp(lgmia(U/(U-1),px,py,pz));
(%o6)
```

$$\begin{bmatrix} 1-U & 0 & 0 & 0 \\ 0 & \frac{(pz^2+py^2)U-pz^2-py^2-px^2}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} & \frac{px\ py\ U}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} & \frac{px\ pz\ U}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} \\ 0 & \frac{px\ py\ U}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} & \frac{(pz^2+px^2)U-pz^2-py^2-px^2}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} & \frac{py\ pz\ U}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} \\ 0 & \frac{px\ pz\ U}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} & \frac{py\ pz\ U}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} & \frac{(py^2+px^2)U-pz^2-py^2-px^2}{(pz^2+py^2+px^2)U-pz^2-py^2-px^2} \end{bmatrix}$$

```
(%i7) uug-ug;
(%o7)
```

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

```
(%i8) ratsimp(diff(ug,x));
(%o8)
```

$$\begin{bmatrix} -U_x & 0 & 0 \\ 0 & -\frac{px^2(U_x)}{(pz^2+py^2+px^2)U^2+(-2pz^2-2py^2-2px^2)U+pz^2+py^2+px^2} & -\frac{px\ py\ (U_x)}{(pz^2+py^2+px^2)U^2+(-2pz^2-2py^2-2px^2)U+pz^2+py^2+px^2} \\ 0 & -\frac{px\ py\ (U_x)}{(pz^2+py^2+px^2)U^2+(-2pz^2-2py^2-2px^2)U+pz^2+py^2+px^2} & -\frac{py^2(U_x)}{(pz^2+py^2+px^2)U^2+(-2pz^2-2py^2-2px^2)U+pz^2+py^2+px^2} \\ 0 & -\frac{px\ pz\ (U_x)}{(pz^2+py^2+px^2)U^2+(-2pz^2-2py^2-2px^2)U+pz^2+py^2+px^2} & -\frac{py\ pz\ (U_x)}{(pz^2+py^2+px^2)U^2+(-2pz^2-2py^2-2px^2)U+pz^2+py^2+px^2} \end{bmatrix}$$

Mostro che le variabili esterne non vengono modificate se sono definite anche come variabili interne al blocco.

```
(%i9) y:100;
(%o9) 100
```

```
(%i10) f(x):=block([y],y:x*x,y+7);
(%o10) f(x):=block([y],y:x x,y+7)
```

```
(%i11) f(3);
(%o11) 16
```

```
(%i12) y;
(%o12) 100
```

Qui assegno alla variabile interna il valore posseduto dalla omonima esterna. Ma l'esterna rimane immutata.

```
(%i13) g(x):=block([y:y],y:y+x^2,y);
(%o13) g(x):=block([y:y],y:y+x^2,y)
```

```
(%i14) g(2);
(%o14) 104
```

```
(%i15) y;
(%o15) 100
```

Ecco un' altra funzione che genera una matrice usando simboli già usati esternamente, ma senza alterarli.

```
(%i16) gm(x):=block([y,z:y],y:matrix([z*z+x*x,-1],[-1,z*z+2]),
invert(y));
(%o16) gm(x):=block([y,z:y],y:matrix([z z+x x -1
-1 z z+2]),invert(y))
```

```
(%i17) gm(1);
(%o17) matrix([
[ 10002 1
100030001 100030001 ]
[ 1 10001
100030001 100030001 ]])
```

```
(%i18) y;
(%o18) 100
```