```
(%i1)  kill(all);
(%o0)  done
```

```
(%i1)  cross(a,b) :=  [a[2]*b[3] - a[3]*b[2],
                       a[3]*b[1] - a[1]*b[3],
                       a[1]*b[2] - a[2]*b[1]];
(%o1)  cross(a, b) := [a_2 b_3 - a_3 b_2, a_3 b_1 - a_1 b_3, a_1 b_2 - a_2 b_1]
```

```
(%i2)  curl(a) := [diff(a[3],y) - diff(a[2],z),
                   diff(a[1],z) - diff(a[3],x),
                   diff(a[2],x) - diff(a[1],y)];
(%o2)  curl(a) := [d/dy a_3 - d/dz a_2, d/dz a_1 - d/dx a_3, d/dx a_2 - d/dy a_1]
```

```
(%i3)  grad(psi) := [diff(psi,x), diff(psi,y), diff(psi,z)];
(%o3)  grad(Ψ) := [d/dx Ψ, d/dy Ψ, d/dz Ψ]
```

1 Equation set of 7 equations

```
(%i4)  depends([omega_0,omega_x,omega_y,omega_z,Q_x,Q_y,Q_z,Phi], [x,y,z,t]
(%o4)  [ω_0(x, y, z, t), ω_x(x, y, z, t), ω_y(x, y, z, t), ω_z(x, y, z, t),
Q_x(x, y, z, t), Q_y(x, y, z, t), Q_z(x, y, z, t), Φ(x, y, z, t)]
```

```
(%i6)  omega: [omega_x, omega_y, omega_z];
       Q: [Q_x, Q_y, Q_z];
(%o5)  [ω_x, ω_y, ω_z]
(%o6)  [Q_x, Q_y, Q_z]
```

1.1 Eq.(15)

```
(%i7)  E15: diff(cross(omega,Q),t) = -omega_0*curl(Q)-cross(grad(omega_0),Q
(%o7)  [-Q_y (d/dt ω_z) - (d/dt Q_y) ω_z + Q_z (d/dt ω_y) + (d/dt Q_z) ω_y, Q_x
(d/dt ω_z) + (d/dt Q_x) ω_z - Q_z (d/dt ω_x) - (d/dt Q_z) ω_x, -Q_x (d/dt ω_y) - (d/dt Q_x)
ω_y + Q_y (d/dt ω_x) + (d/dt Q_y) ω_x] = [Q_y (d/dz ω_0) - Q_z (d/dy ω_0) -
(d/dy Q_z - d/dz Q_y) ω_0, -Q_x (d/dz ω_0) + Q_z (d/dx ω_0) - (d/dz Q_x - d/dx Q_z) ω_0, Q_x
(d/dy ω_0) - Q_y (d/dx ω_0) - (d/dx Q_y - d/dy Q_x) ω_0]
```

1.2 3 Eqs. from Eq.(15)

```
(%i10)  E15a: first(lhs(E15))=first(rhs(E15));
        E15b: second(lhs(E15))=second(rhs(E15));
        E15c: third(lhs(E15))=third(rhs(E15));
```

$$(\%o8)\quad -Q_y\left(\frac{d}{dt}\,\omega_z\right)-\left(\frac{d}{dt}\,Q_y\right)\omega_z+Q_z\left(\frac{d}{dt}\,\omega_y\right)+\left(\frac{d}{dt}\,Q_z\right)\omega_y=Q_y\left(\frac{d}{dz}\,\omega_0\right)-Q_z\left(\frac{d}{dy}\,\omega_0\right)-\left(\frac{d}{dy}\,Q_z-\frac{d}{dz}\,Q_y\right)\omega_0$$

$$(\%o9)\quad Q_x\left(\frac{d}{dt}\,\omega_z\right)+\left(\frac{d}{dt}\,Q_x\right)\omega_z-Q_z\left(\frac{d}{dt}\,\omega_x\right)-\left(\frac{d}{dt}\,Q_z\right)\omega_x=-Q_x\left(\frac{d}{dz}\,\omega_0\right)+Q_z\left(\frac{d}{dx}\,\omega_0\right)-\left(\frac{d}{dz}\,Q_x-\frac{d}{dx}\,Q_z\right)\omega_0$$

$$(\%o10)\quad -Q_x\left(\frac{d}{dt}\,\omega_y\right)-\left(\frac{d}{dt}\,Q_x\right)\omega_y+Q_y\left(\frac{d}{dt}\,\omega_x\right)+\left(\frac{d}{dt}\,Q_y\right)\omega_x=Q_x\left(\frac{d}{dy}\,\omega_0\right)-Q_y\left(\frac{d}{dx}\,\omega_0\right)-\left(\frac{d}{dx}\,Q_y-\frac{d}{dy}\,Q_x\right)\omega_0$$

1.3 Eqs.(19-22)

```
(%i13)  E19: diff(Q_z,y) - omega_y*Q_z = -(diff(Q_y,z) - omega_z*Q_y);
        E20: diff(Q_x,z) - omega_z*Q_x = -(diff(Q_z,x) - omega_x*Q_z);
        E21: diff(Q_y,x) - omega_x*Q_y = -(diff(Q_x,y) - omega_y*Q_x);
```

$$(\%o11)\quad \frac{d}{dy}\,Q_z-Q_z\,\omega_y=Q_y\,\omega_z-\frac{d}{dz}\,Q_y$$

$$(\%o12)\quad \frac{d}{dz}\,Q_x-Q_x\,\omega_z=Q_z\,\omega_x-\frac{d}{dx}\,Q_z$$

$$(\%o13)\quad \frac{d}{dx}\,Q_y-Q_y\,\omega_x=Q_x\,\omega_y-\frac{d}{dy}\,Q_x$$

1.4 Eq.(23)

```
(%i14)  E23: Q_x*(diff(omega_z,y)-diff(omega_y,z))+Q_y*(diff(omega_x,z)-diff
        +Q_z*(diff(omega_y,x)-diff(omega_x,y))
        = omega_x*(diff(Q_z,y)-diff(Q_y,z))+omega_y*(diff(Q_x,z)-diff(Q_z,x)
        +omega_z*(diff(Q_y,x)-diff(Q_x,y));
```

$$(\%o14)\quad Q_x\left(\frac{d}{dy}\,\omega_z-\frac{d}{dz}\,\omega_y\right)+Q_y\left(\frac{d}{dz}\,\omega_x-\frac{d}{dx}\,\omega_z\right)+Q_z\left(\frac{d}{dx}\,\omega_y-\frac{d}{dy}\,\omega_x\right)=\left(\frac{d}{dx}\,Q_y-\frac{d}{dy}\,Q_x\right)\omega_z+\left(\frac{d}{dz}\,Q_x-\frac{d}{dx}\,Q_z\right)\omega_y+\left(\frac{d}{dy}\,Q_z-\frac{d}{dz}\,Q_y\right)\omega_x$$

```
(%i15)  feval(Q_x,Q_y,Q_z,omega_x,omega_y,omega_z,omega_0) := (
            print("E15a: ", R1: ev(E15a,diff)),
            print("E15b: ", R2: ev(E15b,diff)),
            print("E15c: ", R3: ev(E15c,diff)),
            print("E19: ", R4: ev(E19,diff)),
            print("E20: ", R5: ev(E20,diff)),
            print("E21: ", R6: ev(E21,diff)),
            print("E23: ", R7: ev(E23,diff)), ""
            );
```

```
(%o15)  feval(Q_x, Q_y, Q_z, omega_x, omega_y, omega_z, omega_0) := (
print(E15a: , R1 : ev(E15a, diff)), print(E15b: , R2 : ev(E15b, diff)),
print(E15c: , R3 : ev(E15c, diff)), print(E19: , R4 : ev(E19, diff)),
print(E20: , R5 : ev(E20, diff)), print(E21: , R6 : ev(E21, diff)),
print(E23: , R7 : ev(E23, diff)), )
```

2 Special cases

2.1 Q (with 3 oscillatory components)

```
(%i16)  kill(omega_0,omega_x,omega_y,omega_z,Q_x,Q_y,Q_z,Phi,Q_0);
(%o16)  done
```

```
(%i17)  depends([omega_0],[t],[omega_x,omega_y,omega_z,Q_x,Q_y,Q_z,Phi], [x,
(%o17)  [omega_0(t), omega_x(x, y, z), omega_y(x, y, z), omega_z(x, y, z), Q_x(x, y, z), Q_y(x, y, z),
Q_z(x, y, z), Phi(x, y, z)]
```

```
(%i20)  Q_x: Q_1*cos(%beta*t-(k_x*x+k_y*y+k_z*z));
        Q_y: Q_2*cos(%beta*t-(k_x*x+k_y*y+k_z*z));
        Q_z: Q_3*cos(%beta*t-(k_x*x+k_y*y+k_z*z));
```

$$(\%o18)\quad Q_1 \cos\left(k_z\, z + k_y\, y + k_x\, x - \beta\, t\right)$$

$$(\%o19)\quad Q_2 \cos\left(k_z\, z + k_y\, y + k_x\, x - \beta\, t\right)$$

$$(\%o20)\quad Q_3 \cos\left(k_z\, z + k_y\, y + k_x\, x - \beta\, t\right)$$

(%i21) `feval(Q_x,Q_y,Q_z,omega_x,omega_y,omega_z,omega_0);`

$$E15a:\quad \beta\, Q_3\, \omega_y \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-\beta\, Q_2\, \omega_z \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=-\omega_0 \left(Q_2\, k_z \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_3\, k_y \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)\right)$$

$$E15b:\quad \beta\, Q_1\, \omega_z \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-\beta\, Q_3\, \omega_x \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=-\omega_0 \left(Q_3\, k_x \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_1\, k_z \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)\right)$$

$$E15c:\quad \beta\, Q_2\, \omega_x \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-\beta\, Q_1\, \omega_y \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=-\omega_0 \left(Q_1\, k_y \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_2\, k_x \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)\right)$$

$$E19:\quad -Q_3\, k_y \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_3\, \omega_y \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=Q_2\, k_z \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)+Q_2\, \omega_z \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)$$

$$E20:\quad -Q_1\, k_z \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_1\, \omega_z \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=Q_3\, k_x \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)+Q_3\, \omega_x \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)$$

$$E21:\quad -Q_2\, k_x \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_2\, \omega_x \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=Q_1\, k_y \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)+Q_1\, \omega_y \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)$$

$$E23:\quad Q_1 \left(\frac{\mathrm{d}}{\mathrm{d}\, y}\, \omega_z-\frac{\mathrm{d}}{\mathrm{d}\, z}\, \omega_y\right) \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)+Q_2 \left(\frac{\mathrm{d}}{\mathrm{d}\, z}\, \omega_x-\frac{\mathrm{d}}{\mathrm{d}\, x}\, \omega_z\right) \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)+Q_3 \left(\frac{\mathrm{d}}{\mathrm{d}\, x}\, \omega_y-\frac{\mathrm{d}}{\mathrm{d}\, y}\, \omega_x\right) \cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=\omega_x \left(Q_2\, k_z \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_3\, k_y \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)\right)+\omega_y \left(Q_3\, k_x \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_1\, k_z \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)\right)+\omega_z \left(Q_1\, k_y \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_2\, k_x \sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)\right)$$

(%o21)

```
(%i28)  ratsimp(R1/sin(k_z*z+k_y*y+k_x*x-%beta*t));
        ratsimp(R2/sin(k_z*z+k_y*y+k_x*x-%beta*t));
        ratsimp(R3/sin(k_z*z+k_y*y+k_x*x-%beta*t));
        ratsimp(R4);
        ratsimp(R5);
        ratsimp(R6);
        ratsimp(R7);
```

$$(\%o22)\quad \beta\, Q_3\, \omega_y-\beta\, Q_2\, \omega_z=\left(Q_3\, k_y-Q_2\, k_z\right)\omega_0$$

$$(\%o23)\quad \beta\, Q_1\, \omega_z-\beta\, Q_3\, \omega_x=\left(Q_1\, k_z-Q_3\, k_x\right)\omega_0$$

$$(\%o24)\quad \beta\, Q_2\, \omega_x-\beta\, Q_1\, \omega_y=\left(Q_2\, k_x-Q_1\, k_y\right)\omega_0$$

$$(\%o25)\quad -Q_3\, k_y\,\sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_3\,\omega_y\,\cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=Q_2\, k_z\,\sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)+Q_2\,\omega_z\,\cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)$$

$$(\%o26)\quad -Q_1\, k_z\,\sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_1\,\omega_z\,\cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=Q_3\, k_x\,\sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)+Q_3\,\omega_x\,\cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)$$

$$(\%o27)\quad -Q_2\, k_x\,\sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)-Q_2\,\omega_x\,\cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=Q_1\, k_y\,\sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)+Q_1\,\omega_y\,\cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)$$

$$(\%o28)\quad \left(Q_1\left(\frac{\mathrm{d}}{\mathrm{d}\, y}\,\omega_z\right)-Q_2\left(\frac{\mathrm{d}}{\mathrm{d}\, x}\,\omega_z\right)-Q_1\left(\frac{\mathrm{d}}{\mathrm{d}\, z}\,\omega_y\right)+Q_3\left(\frac{\mathrm{d}}{\mathrm{d}\, x}\,\omega_y\right)+Q_2\left(\frac{\mathrm{d}}{\mathrm{d}\, z}\,\omega_x\right)-Q_3\left(\frac{\mathrm{d}}{\mathrm{d}\, y}\,\omega_x\right)\right)\cos\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)=\left(\left(Q_1\, k_y-Q_2\, k_x\right)\omega_z+\left(Q_3\, k_x-Q_1\, k_z\right)\omega_y+\left(Q_2\, k_z-Q_3\, k_y\right)\omega_x\right)\sin\left(k_z\, z+k_y\, y+k_x\, x-\beta\, t\right)$$

2.2 Q (with 2 osc. components), omega=const.

```
(%i29)  kill(omega_0,omega_x,omega_y,omega_z,Q_x,Q_y,Q_z,Phi,Q_0);
(%o29)  done

(%i30)  depends([omega_0],[t],[omega_x,omega_y,omega_z,Q_x,Q_y,Q_z,Phi], [x,
```

$$(\%o30)\quad [\omega_0(t),\omega_x(x,y,z),\omega_y(x,y,z),\omega_z(x,y,z),Q_x(x,y,z),Q_y(x,y,z),Q_z(x,y,z),\mathrm{Phi}(x,y,z)]$$

```
(%i33)  Q_x: Q_1*cos(%beta*t-(k_x*x+k_y*y));
        Q_y: Q_2*sin(%beta*t-(k_x*x+k_y*y));
        Q_z: Q_3;
```

$$(\%o31)\quad Q_1\,\cos\left(k_y\, y+k_x\, x-\beta\, t\right)$$

$$(\%o32)\quad -Q_2\,\sin\left(k_y\, y+k_x\, x-\beta\, t\right)$$

$$(\%o33)\quad Q_3$$

```
(%i36)  omega_x: 0;
        omega_y: 0;
        omega_z: kappa;
(%o34)  0
(%o35)  0
(%o36)  κ
```

```
(%i37)  feval(Q_x,Q_y,Q_z,omega_x,omega_y,omega_z,omega_0);
```

$$E15a: \quad -\beta\, Q_2\, \kappa \cos\left(k_y\, y + k_x\, x - \beta\, t\right) = 0$$

$$E15b: \quad \beta\, Q_1\, \kappa \sin\left(k_y\, y + k_x\, x - \beta\, t\right) = 0$$

$$E15c: \quad 0 = -\omega_0 \left(Q_1\, k_y \sin\left(k_y\, y + k_x\, x - \beta\, t\right) - Q_2\, k_x \cos\left(k_y\, y + k_x\, x - \beta\, t\right)\right)$$

$$E19: \quad 0 = -Q_2\, \kappa \sin\left(k_y\, y + k_x\, x - \beta\, t\right)$$

$$E20: \quad -Q_1\, \kappa \cos\left(k_y\, y + k_x\, x - \beta\, t\right) = 0$$

$$E21: \quad -Q_2\, k_x \cos\left(k_y\, y + k_x\, x - \beta\, t\right) = Q_1\, k_y \sin\left(k_y\, y + k_x\, x - \beta\, t\right)$$

$$E23: \quad 0 = \kappa \left(Q_1\, k_y \sin\left(k_y\, y + k_x\, x - \beta\, t\right) - Q_2\, k_x \cos\left(k_y\, y + k_x\, x - \beta\, t\right)\right)$$

```
(%o37)
```

```
(%i44)  E1: ratsimp(R1/cos(k_y*y+k_x*x-%beta*t));
        E2: ratsimp(R2/sin(k_y*y+k_x*x-%beta*t));
        E3: ratsimp(R3/sin(k_y*y+k_x*x-%beta*t));
        E4: ratsimp(R4/sin(k_y*y+k_x*x-%beta*t));
        E5: ratsimp(R5/cos(k_y*y+k_x*x-%beta*t));
        E6: ratsimp(R6/sin(k_y*y+k_x*x-%beta*t));
        E7: ratsimp(R7/sin(k_y*y+k_x*x-%beta*t));
```

$$(\%o38) \quad -\beta\, Q_2\, \kappa = 0$$

$$(\%o39) \quad \beta\, Q_1\, \kappa = 0$$

$$(\%o40) \quad 0 = -\frac{Q_1\, k_y\, \omega_0 \sin\left(k_y\, y + k_x\, x - \beta\, t\right) - Q_2\, k_x\, \omega_0 \cos\left(k_y\, y + k_x\, x - \beta\, t\right)}{\sin\left(k_y\, y + k_x\, x - \beta\, t\right)}$$

$$(\%o41) \quad 0 = -Q_2\, \kappa$$

$$(\%o42) \quad -Q_1\, \kappa = 0$$

$$(\%o43) \quad -\frac{Q_2\, k_x \cos\left(k_y\, y + k_x\, x - \beta\, t\right)}{\sin\left(k_y\, y + k_x\, x - \beta\, t\right)} = Q_1\, k_y$$

$$(\%o44) \quad 0 = \frac{Q_1\, k_y\, \kappa \sin\left(k_y\, y + k_x\, x - \beta\, t\right) - Q_2\, k_x\, \kappa \cos\left(k_y\, y + k_x\, x - \beta\, t\right)}{\sin\left(k_y\, y + k_x\, x - \beta\, t\right)}$$

```
(%i45)  solve([E3,E2,E1], [Q1,Q2,Q3]);
(%o45)  []
```

```
(%i46)  solve([E1,E2,E7], [k_x,k_y,k_z]);
(%o46)  []
```

2.3 general Q, omega=const.

```
(%i47)  kill(omega_0,omega_x,omega_y,omega_z,Q_x,Q_y,Q_z,Phi,Q_0);
(%o47)  done
```

```
(%i48)  depends([omega_0],[t],[omega_x,omega_y,omega_z,Q_x,Q_y,Q_z,Phi], [x,
(%o48)  [ω0(t), ωx(x, y, z, t), ωy(x, y, z, t), ωz(x, y, z, t), Qx(x, y, z, t),
Qy(x, y, z, t), Qz(x, y, z, t), Phi(x, y, z, t)]
```

```
(%i51)  omega_x: 0;
        omega_y: 0;
        omega_z: kappa;
(%o49)  0
(%o50)  0
(%o51)  κ
```

```
(%i52)  feval(Q_x,Q_y,Q_z,omega_x,omega_y,omega_z,omega_0);
```

$$E15a:\quad -\left(\frac{\mathrm{d}}{\mathrm{d}\,t}\,Q_y\right)\kappa=-\left(\frac{\mathrm{d}}{\mathrm{d}\,y}\,Q_z-\frac{\mathrm{d}}{\mathrm{d}\,z}\,Q_y\right)\omega_0$$

$$E15b:\quad \left(\frac{\mathrm{d}}{\mathrm{d}\,t}\,Q_x\right)\kappa=-\left(\frac{\mathrm{d}}{\mathrm{d}\,z}\,Q_x-\frac{\mathrm{d}}{\mathrm{d}\,x}\,Q_z\right)\omega_0$$

$$E15c:\quad 0=-\left(\frac{\mathrm{d}}{\mathrm{d}\,x}\,Q_y-\frac{\mathrm{d}}{\mathrm{d}\,y}\,Q_x\right)\omega_0$$

$$E19:\quad \frac{\mathrm{d}}{\mathrm{d}\,y}\,Q_z=Q_y\,\kappa-\frac{\mathrm{d}}{\mathrm{d}\,z}\,Q_y$$

$$E20:\quad \frac{\mathrm{d}}{\mathrm{d}\,z}\,Q_x-Q_x\,\kappa=-\frac{\mathrm{d}}{\mathrm{d}\,x}\,Q_z$$

$$E21:\quad \frac{\mathrm{d}}{\mathrm{d}\,x}\,Q_y=-\frac{\mathrm{d}}{\mathrm{d}\,y}\,Q_x$$

$$E23:\quad 0=\left(\frac{\mathrm{d}}{\mathrm{d}\,x}\,Q_y-\frac{\mathrm{d}}{\mathrm{d}\,y}\,Q_x\right)\kappa$$

```
(%o52)
```

2.4 Additionally: Q_x = Q_y = f(t) only

```
(%i55)  Q_x: q*sin(%beta*t);
        Q_y: q*cos(%beta*t);
        Q_z: a(t)*x+b(t)*y;
(%o53)  q sin(β t)
(%o54)  q cos(β t)
(%o55)  b(t) y+a(t) x
```

```
(%i56)  feval(Q_x,Q_y,Q_z,omega_x,omega_y,omega_z,omega_0);
```

$$E15a:\quad \beta\,\kappa\,q\sin(\beta\,t)=-\omega_0\,\mathrm{b}(t)$$

$$E15b:\quad \beta\,\kappa\,q\cos(\beta\,t)=\omega_0\,\mathrm{a}(t)$$

$$E15c:\quad 0=0$$

$$E19:\quad \mathrm{b}(t)=\kappa\,q\cos(\beta\,t)$$

$$E20:\quad -\kappa\,q\sin(\beta\,t)=-\mathrm{a}(t)$$

$$E21:\quad 0=0$$

$$E23:\quad 0=0$$

```
(%o56)
```

```
(%i57)  Omega: curl([Q_x,Q_y,Q_z])-cross([0,0,kappa],[Q_x,Q_y,Q_z]);
(%o57)  [κ q cos(β t)+b(t), -κ q sin(β t)-a(t), 0]
```

```
(%i58)  ev(Omega, [a(t)=kappa*q*cos(%beta*t), b(t)=-kappa*q*sin(%beta*t)]);
(%o58)  [κ q cos(β t)-κ q sin(β t), -κ q sin(β t)-κ q cos(β t), 0]
```

```
(%i59)  Omega: (-sqrt(2)*kappa*q*[sin(%beta*t-%pi/4), sin(%beta*t+%pi/4), 0]
```

(%o59) $$\left[-\sqrt{2}\,\kappa\,q\,\sin\left(\beta\,t-\frac{\pi}{4}\right),-\sqrt{2}\,\kappa\,q\,\sin\left(\beta\,t+\frac{\pi}{4}\right),0\right]$$