

```
> restart;
> with(PDEtools) :
```

## Chapter 4 Problem 16: Maple solutions to the differential equations

This is the system of differential equations

```
> e0 := { \frac{\partial}{\partial t} \alpha(t) - \frac{w0}{2 \cdot I} \cdot \alpha(t) - \frac{wI}{2 \cdot I} \cdot \beta(t) \cdot e^{-I \cdot w \cdot t} = 0, \frac{\partial}{\partial t} \beta(t) + \frac{w0}{2 \cdot I} \cdot \beta(t) - \frac{wI}{2 \cdot I} \cdot \alpha(t) \cdot e^{I \cdot w \cdot t} = 0 } :
```

The Maple function pdsolve() places the solutions in a list.

```
> L := pdsolve(e0) :
```

```
> L[1] :
```

```
a := unapply(rhs(%), t) :
```

```
\alpha := t \rightarrow subs(ln(e) = 1, a(t)) :
```

```
'\alpha(t)' = \alpha(t);
```

```
e1 := \alpha(0) = 1;
```

$$\alpha(t) = \_C1 e^{-\frac{1}{2} I (w + \sqrt{w^2 + w0^2 + wI^2 - 2 w w0}) t} + \_C2 e^{-\frac{1}{2} I (w - \sqrt{w^2 + w0^2 + wI^2 - 2 w w0}) t}$$

$$e1 := \_C1 + \_C2 = 1$$

(1)

```
> L[2] :
```

```
b := unapply(rhs(%), t) :
```

```
\beta := t \rightarrow subs(ln(e) = 1, b(t)) :
```

```
'\beta(t)' = \beta(t);
```

```
e2 := \beta(0) = 0;
```

$$\beta(t) = -\frac{1}{wI} \left( e^{I w t} \left( \_C2 \left( -w + \sqrt{w^2 + w0^2 + wI^2 - 2 w w0} + w0 \right) e^{-\frac{1}{2} I (w - \sqrt{w^2 + w0^2 + wI^2 - 2 w w0}) t} \right. \right.$$

$$\left. \left. - \_C1 e^{-\frac{1}{2} I (w + \sqrt{w^2 + w0^2 + wI^2 - 2 w w0}) t} \left( w + \sqrt{w^2 + w0^2 + wI^2 - 2 w w0} - w0 \right) \right) \right)$$

$$e2 := -\frac{\_C2 \left( -w + \sqrt{w^2 + w0^2 + wI^2 - 2 w w0} + w0 \right) - \_C1 \left( w + \sqrt{w^2 + w0^2 + wI^2 - 2 w w0} - w0 \right)}{wI}$$

$$= 0$$

(2)

```
> L2 := solve([e1, e2], [_C1, _C2]) :
```

```
L2[1][1];
```

```
L2[1][2];
```

$$\_C1 = \frac{1}{2} \frac{-\sqrt{w^2 + w0^2 + wI^2 - 2 w w0} w + w^2 + w0^2 + wI^2 - 2 w w0 + \sqrt{w^2 + w0^2 + wI^2 - 2 w w0} w0}{w^2 + w0^2 + wI^2 - 2 w w0}$$

$$\_C2 = \frac{1}{2} \frac{\sqrt{w^2 + w0^2 + wI^2 - 2 w w0} w - \sqrt{w^2 + w0^2 + wI^2 - 2 w w0} w0 + w^2 + w0^2 + wI^2 - 2 w w0}{w^2 + w0^2 + wI^2 - 2 w w0}$$

(3)