```
Exit[]

$Assumptions = t > 0;

er := {Cos[a[t]], Sin[a[t]]}; ea := D[er, t] / D[a[t], t];

RS = {RS1, RS2}; rs := t^2 / 2 * RS; r = {rs + b * er, rs - b * ea, rs + b / 2 * (ea - er)};

m = {1, 1, 2}; F[i_] := Fr[i] * er + Fa[i] * ea

f := {(rr[1] - rr[2])^2, (rr[1] - rr[3])^2, (rr[2] - rr[3])^2};

eq1 =
  Table[Simplify[m[[i]] * D[r[[i]], {t, 2}] - F[i] - Sum[L[j] / 2 / b * D[f[[j]], rr[i]] /.
      {rr[1] → r[[1]], rr[2] → r[[2]], rr[3] → r[[3]]}, {j, 3}]], {i, 3}];

{RS1, RS2} = chi[t] * er + phi[t] * ea;
eq2 = Simplify[Normal[SparseArray[{{i_} /; i < 4 → eq1[[i]].er,
     {i_} /; i > 3 → eq1[[i - 3]].ea}, {6}]]]; eq2 // MatrixForm
```

Part::pspec : Part specification i is neither an integer nor a list of integers. ≫

Part::pspec : Part specification −3 + i is neither an integer nor a list of integers. ≫

$$\begin{pmatrix} \text{chi}[t] - \text{Fr}[1] - \text{L}[1] - \frac{3\,\text{L}[2]}{2} - b\,a'[t]^2 \\ \text{chi}[t] - \text{Fr}[2] + \text{L}[1] - \frac{\text{L}[3]}{2} + b\,a''[t] \\ \frac{1}{2}\left(4\,\text{chi}[t] - 2\,\text{Fr}[3] + 3\,\text{L}[2] + \text{L}[3] + 2\,b\,a'[t]^2 - 2\,b\,a''[t]\right) \\ -\text{Fa}[1] - \text{L}[1] + \frac{\text{L}[2]}{2} + \text{phi}[t] + b\,a''[t] \\ -\text{Fa}[2] + \text{L}[1] + \frac{3\,\text{L}[3]}{2} + \text{phi}[t] + b\,a'[t]^2 \\ \frac{1}{2}\left(-2\,\text{Fa}[3] - \text{L}[2] - 3\,\text{L}[3] + 4\,\text{phi}[t] - 2\,b\,a'[t]^2 - 2\,b\,a''[t]\right) \end{pmatrix}$$

```
M = {{1, 3 / 2, 0}, {-1, 0, 1 / 2}, {1, -1 / 2, 0}}; M // MatrixForm
```

$$\begin{pmatrix} 1 & \frac{3}{2} & 0 \\ -1 & 0 & \frac{1}{2} \\ 1 & -\frac{1}{2} & 0 \end{pmatrix}$$

```
Eliminate[eq2[[1 ;; 2]] == 0, L[1]]
```

True

eq2[[1]]

Part::pspec : Part specification 5((1)..) is neither an integer nor a list of integers. ≫

$$\left\{\text{chi}[t]-\text{Fr}[1]-\text{L}[1]-\frac{3\,\text{L}[2]}{2}-\text{b}\,a'[t]^2,\ \text{chi}[t]-\text{Fr}[2]+\text{L}[1]-\frac{\text{L}[3]}{2}+\text{b}\,a''[t],\right.$$
$$\frac{1}{2}\left(4\,\text{chi}[t]-2\,\text{Fr}[3]+3\,\text{L}[2]+\text{L}[3]+2\,\text{b}\,a'[t]^2-2\,\text{b}\,a''[t]\right),$$
$$-\text{Fa}[1]-\text{L}[1]+\frac{\text{L}[2]}{2}+\text{phi}[t]+\text{b}\,a''[t],\ -\text{Fa}[2]+\text{L}[1]+\frac{3\,\text{L}[3]}{2}+\text{phi}[t]+\text{b}\,a'[t]^2,$$
$$\left.\frac{1}{2}\left(-2\,\text{Fa}[3]-\text{L}[2]-3\,\text{L}[3]+4\,\text{phi}[t]-2\,\text{b}\,a'[t]^2-2\,\text{b}\,a''[t]\right)\right\}[\![5\,((1)\,..)]\!]$$