```
Exit[]
```

```
PrependTo[$Path, "D:\\Users\\Johannes\\Promotion\\Mathematica\\Packages"]; << JoFin`
```

```
n = 1;
dS[i_] := r S[i] dt + σ[i] S[i] dB[i];
```

$$\text{dP} = \text{Expand}\left[\sum_{i=1}^{n} q[i]\, dS[i] + \left(P - \sum_{i=1}^{n} q[i]\, S[i]\right) r\, dt\right]$$

```
coef = CoefficientArrays[dP, Prepend[Table[dB[i], {i, n + 1}], dt]][[2]];
S[n + 1] := P;
mm = MMc[{coef[[1]]}, {coef[[2 ;; n + 2]]}];
Print["Resulting system of SDEs:", MatrixForm /@ mm];
mmd = mm; MMdisc[mm] / {1, {{1, 1}, {S[1], 1}}, 1};
Print["Resulting system of SDEs:", MatrixForm /@ mmd];
dfk = Expand[FK[V, mmd, r]]
```

$$dt\, P\, r + dB[1]\, q[1]\, S[1]\, \sigma[1]$$

Resulting system of SDEs: $\left\{\begin{pmatrix} r\,S[1] \\ P\, r \end{pmatrix}, \begin{pmatrix} S[1]\,\sigma[1] & 0 \\ q[1]\,S[1]\,\sigma[1] & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\right\}$

The resulting system of SDEs: $\left\{\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} S[1]\,\sigma[1] & 0 \\ q[1]\,S[1]\,\sigma[1] & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\right\}$

Resulting system of SDEs: $\left\{\begin{pmatrix} r\,S[1] \\ P\, r \end{pmatrix}, \begin{pmatrix} S[1]\,\sigma[1] & 0 \\ q[1]\,S[1]\,\sigma[1] & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\right\}$

$$-r\, V[t, S[1], P] + P\, r\, V^{(0,0,1)}[t, S[1], P] + \frac{1}{2} q[1]^2 S[1]^2 \sigma[1]^2 V^{(0,0,2)}[t, S[1], P] + r\, S[1]\, V^{(0,1,0)}[t, S[1], P] + q[1]\, S[1]^2 \sigma[1]^2 V^{(0,1,1)}[t, S[1], P] + \frac{1}{2} S[1]^2 \sigma[1]^2 V^{(0,2,0)}[t, S[1], P] + V^{(1,0,0)}[t, S[1], P]$$

```
V3 := #2 V[#1, #3 / #2] &;
```

```
dfk = Expand[DFK[V3, mmd] / S[1] /. P → P S[1]]
```

$$r\, V[t, P] + \frac{1}{2} P^2 \sigma[1]^2 V^{(0,2)}[t, P] - P\, q[1]\, \sigma[1]^2 V^{(0,2)}[t, P] + \frac{1}{2} q[1]^2 \sigma[1]^2 V^{(0,2)}[t, P] + V^{(1,0)}[t, P]$$

```
MatrixForm /@ CoefficientArrays[dfk, Table[q[i], {i, n}], Symmetric → True]
```

$$\left\{-r\, V[t, S[1], P] + P\, r\, V^{(0,0,1)}[t, S[1], P] + r\, S[1]\, V^{(0,1,0)}[t, S[1], P] + \frac{1}{2} S[1]^2 \sigma[1]^2 V^{(0,2,0)}[t, S[1], P] + V^{(1,0,0)}[t, S[1], P], \left(S[1]^2 \sigma[1]^2 V^{(0,1,1)}[t, S[1], P]\right), \left(\tfrac{1}{2} S[1]^2 \sigma[1]^2 V^{(0,0,2)}[t, S[1], P]\right)\right\}$$

constant volatility

The option value will be independent of the asset prices, as can be veryfied by the absence of S terms in the following equation:

```
V2 := ToExpression[StringJoin["V[#1,#", ToString[n + 2], "]&"]];
dfkC = Simplify[DFK[V2, mm]]
```

$$P\ r\ V^{(0,1)}[t, P] + \frac{1}{2}\ q[1]^2\ \sigma[1]^2\ V^{(0,2)}[t, P] + V^{(1,0)}[t, P]$$

```
coef = CoefficientArrays[dfkC, Table[q[i], {i, n}], Symmetric → True]; MatrixForm /@ coef
```

$$\left\{V^{(1,0)}[t, P],\ \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix},\ \begin{pmatrix} \frac{1}{2}\ \sigma[1]^2\ V^{(0,2)}[t, P] & \frac{1}{2}\ \rho[1, 2]\ \sigma[1]\ \sigma[2]\ V^{(0,2)}[t, P] & \frac{1}{2}\ \rho \\ \frac{1}{2}\ \rho[1, 2]\ \sigma[1]\ \sigma[2]\ V^{(0,2)}[t, P] & \frac{1}{2}\ \sigma[2]^2\ V^{(0,2)}[t, P] & \frac{1}{2}\ \rho \\ \frac{1}{2}\ \rho[1, 3]\ \sigma[1]\ \sigma[3]\ V^{(0,2)}[t, P] & \frac{1}{2}\ \rho[2, 3]\ \sigma[2]\ \sigma[3]\ V^{(0,2)}[t, P] & \\ \frac{1}{2}\ \rho[1, 4]\ \sigma[1]\ \sigma[4]\ V^{(0,2)}[t, P] & \frac{1}{2}\ \rho[2, 4]\ \sigma[2]\ \sigma[4]\ V^{(0,2)}[t, P] & \frac{1}{2}\ \rho \end{pmatrix}\right.$$