Condition Limite gauche de Neumann discrétisée par un schéma centré

```
> restart : with(LinearAlgebra) :
> L := 20;  H := 20;  ndx := 3;  ndy := 3;
```

$$L := 20$$
$$H := 20$$
$$ndx := 3$$
$$ndy := 3 \tag{1.1}$$

```
> Td := 10;  Tb := 10;  Th := 30;  α := 0
```

$$Td := 10$$
$$Tb := 10$$
$$Th := 30$$
$$\alpha := 0 \tag{1.2}$$

> $\Delta x := \frac{L}{ndx}$; $\Delta y := \frac{H}{ndy}$; $\beta := \frac{\Delta x}{\Delta y}$

$$\Delta x := \frac{20}{3}$$
$$\Delta y := \frac{20}{3}$$
$$\beta := 1 \tag{1.3}$$

> $i_{max} := ndx + 1$; $j_{max} := ndy + 1$;

$$i_{max} := 4$$
$$j_{max} := 4 \tag{1.4}$$

> $N := (i_{max} - 2) \cdot (j_{max} - 2) + j_{max} - 2$;

$$N := 6 \tag{1.5}$$

> **for** j **from** 2 **to** $j_{max} - 1$ **do** $T[i_{max}, j] := Td$ **end do**;

$$T_{4,2} := 10$$
$$T_{4,3} := 10 \tag{1.6}$$

> **for** i **from** 1 **to** $i_{max} - 1$ **do** $T[i, 1] := Tb$ **end do**;

$$T_{1,1} := 10$$
$$T_{2,1} := 10$$
$$T_{3,1} := 10 \tag{1.7}$$

> **for** i **from** 1 **to** $i_{max} - 1$ **do** $T[i, j_{max}] := Th$ **end do**;

$$T_{1,4} := 30$$
$$T_{2,4} := 30$$
$$T_{3,4} := 30 \tag{1.8}$$

```
k := 1 :
 for j from 2 to j_max − 1 do
     T[0, j] := T[2, j]-2·α·Δx :
     Eq[k] := − 2·(1 + β^2)·T[1, j] + T[2, j] + T[0, j] + β^2·(T[1, j + 1] + T[1, j
   − 1]) = 0 :
     Temps[k] := T[1, j] :
     k  :=  k + 1 :
     for i from 2 to i_max  -1 do
            Eq[k] := − 2·(1 + β^2)·T[i, j] + T[i + 1, j] + T[i − 1, j] + β^2
   ·(T[i, j + 1] + T[i, j-1]) = 0 :
            Temps[k] := T[i, j] :
            k  :=  k + 1 :
     end do
end do:
```

```
> for k from 1 to N do Eq[k] end do;
```

$$-4\,T_{1,\,2}+2\,T_{2,\,2}+T_{1,\,3}+10=0$$

$$-4\,T_{2,\,2}+T_{3,\,2}+T_{1,\,2}+T_{2,\,3}+10=0$$

$$-4\,T_{3,\,2}+20+T_{2,\,2}+T_{3,\,3}=0$$

$$-4\,T_{1,\,3}+2\,T_{2,\,3}+30+T_{1,\,2}=0$$

$$-4\,T_{2,\,3}+T_{3,\,3}+T_{1,\,3}+30+T_{2,\,2}=0$$

$$-4\,T_{3,\,3}+40+T_{2,\,3}+T_{3,\,2}=0 \qquad \textbf{(1.9)}$$

```
> N := k − 1;
```

$$N := 6 \qquad \textbf{(1.10)}$$

```
> Eqs := {seq(Eq[k], k = 1 ..N)};
```

$$Eqs := \{-4\,T_{1,\,2}+2\,T_{2,\,2}+T_{1,\,3}+10=0,\ -4\,T_{1,\,3}+2\,T_{2,\,3}+30+T_{1,\,2}=0,\ -4\,T_{3,\,2}+20+T_{2,\,2}+T_{3,\,3}=0,\ -4\,T_{3,\,3}+40+T_{2,\,3}+T_{3,\,2}=0,\ -4\,T_{2,\,2}+T_{3,\,2}+T_{1,\,2}+T_{2,\,3}+10=0,\ -4\,T_{2,\,3}+T_{3,\,3}+T_{1,\,3}+30+T_{2,\,2}=0\} \qquad \textbf{(1.11)}$$

```
> Tmps := [seq(Temps[k], k = 1 ..N)];
```

$$Tmps := [T_{1,\,2}, T_{2,\,2}, T_{3,\,2}, T_{1,\,3}, T_{2,\,3}, T_{3,\,3}] \qquad \textbf{(1.12)}$$

```
> SolT := solve(Eqs, Tmps);
```

$$SolT := \left[\left[T_{1,\,2}=\frac{1546}{99}, T_{2,\,2}=\frac{500}{33}, T_{3,\,2}=\frac{1334}{99}, T_{1,\,3}=\frac{2194}{99}, T_{2,\,3}=\frac{710}{33}, T_{3,\,3}=\frac{1856}{99}\right]\right] \qquad \textbf{(1.13)}$$

```
> Eqs := [seq(Eq[k], k = 1 ..N)];
```

$$Eqs := [-4\,T_{1,\,2}+2\,T_{2,\,2}+T_{1,\,3}+10=0,\ -4\,T_{2,\,2}+T_{3,\,2}+T_{1,\,2}+T_{2,\,3}+10=0,\ -4\,T_{3,\,2}+20+T_{2,\,2}+T_{3,\,3}=0,\ -4\,T_{1,\,3}+2\,T_{2,\,3}+30+T_{1,\,2}=0,\ -4\,T_{2,\,3}+T_{3,\,3}+T_{1,\,3}+30+T_{2,\,2}=0,\ -4\,T_{3,\,3}+40+T_{2,\,3}+T_{3,\,2}=0] \qquad \textbf{(1.14)}$$

```
> M, R := GenerateMatrix(Eqs, Tmps)
```

$$M, R := \begin{bmatrix} -4 & 2 & 0 & 1 & 0 & 0 \\ 1 & -4 & 1 & 0 & 1 & 0 \\ 0 & 1 & -4 & 0 & 0 & 1 \\ 1 & 0 & 0 & -4 & 2 & 0 \\ 0 & 1 & 0 & 1 & -4 & 1 \\ 0 & 0 & 1 & 0 & 1 & -4 \end{bmatrix}, \begin{bmatrix} -10 \\ -10 \\ -20 \\ -30 \\ -30 \\ -40 \end{bmatrix} \tag{1.15}$$