Condition Limite droite de Neumann discrétisée par un schéma centré:

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> restart : with(LinearAlgebra) :
> L := 20; H := 20; ndx := 3; ndy := 3;
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$$L := 20$$
$$H := 20$$
$$ndx := 3$$
$$ndy := 3 \qquad (1.1)$$

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> Tg := 10; Tb := 10; Th := 30; α := 0
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$$Tg := 10$$
$$Tb := 10$$
$$Th := 30$$
$$\alpha := 0 \qquad (1.2)$$

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

$$\Delta x := \frac{20}{3}$$
$$\Delta y := \frac{20}{3}$$
$$\beta := 1 \qquad (1.3)$$

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

$$i_{max} := 4$$
$$j_{max} := 4 \qquad (1.4)$$

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

$$N := 6 \qquad (1.5)$$

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

$$T_{1,2} := 10$$
$$T_{1,3} := 10 \qquad (1.6)$$

> **for** i **from** 2 **to** i_{max} **do** $T[i, 1] := Tb$ **end do**;

$$T_{2,1} := 10$$
$$T_{3,1} := 10$$
$$T_{4,1} := 10 \qquad (1.7)$$

> **for** i **from** 2 **to** i_{max} **do** $T[i, j_{max}] := Th$ **end do**;

$$T_{2,4} := 30$$
$$T_{3,4} := 30$$
$$T_{4,4} := 30 \qquad (1.8)$$

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

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

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

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

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

$$-4\,T_{2,3}+T_{3,3}+40+T_{2,2}=0$$

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

$$-4\,T_{4,3}+2\,T_{3,3}+30+T_{4,2}=0 \qquad \textbf{(1.9)}$$

> N := k − 1;

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

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

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

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

$$Tmps := [T_{2,2}, T_{3,2}, T_{4,2}, T_{2,3}, T_{3,3}, T_{4,3}] \qquad \textbf{(1.12)}$$

> SolT := solve(Eqs, Tmps);

$$SolT := \left[\left[T_{2,2}=\frac{1334}{99}, T_{3,2}=\frac{500}{33}, T_{4,2}=\frac{1546}{99}, T_{2,3}=\frac{1856}{99}, T_{3,3}=\frac{710}{33}, T_{4,3}=\frac{2194}{99}\right]\right] \qquad \textbf{(1.13)}$$

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

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

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> M, R := GenerateMatrix(Eqs, Tmps)
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$$M, R := \begin{bmatrix} -4 & 1 & 0 & 1 & 0 & 0 \\ 1 & -4 & 1 & 0 & 1 & 0 \\ 0 & 2 & -4 & 0 & 0 & 1 \\ 1 & 0 & 0 & -4 & 1 & 0 \\ 0 & 1 & 0 & 1 & -4 & 1 \\ 0 & 0 & 1 & 0 & 2 & -4 \end{bmatrix}, \begin{bmatrix} -20 \\ -10 \\ -10 \\ -40 \\ -30 \\ -30 \end{bmatrix} \quad (1.15)$$