Conditions Limites gauche et droite de Neumann discrétisée par des schémas décentrés d'ordre 1

> restart : with(LinearAlgebra) :

> $L := 20;\ H := 20;\ ndx := 3;\ ndy := 3;$

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

> $Tb := 100;\ Th := 40;\ \alpha[g] := 0;\ \alpha[d] := 0$

$$Tb := 100$$
$$Th := 40$$
$$\alpha_g := 0$$
$$\alpha_d := 0 \tag{1.2}$$

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

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

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

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

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

$$N := 4 \tag{1.5}$$

(1.6)

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

$$T_{1,\,1} := 100$$
$$T_{2,\,1} := 100$$
$$T_{3,\,1} := 100$$
$$T_{4,\,1} := 100 \tag{1.7}$$

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

$$T_{1,\,4} := 40$$
$$T_{2,\,4} := 40$$
$$T_{3,\,4} := 40$$
$$T_{4,\,4} := 40 \tag{1.8}$$

```
k := 1 :

 for j from 2 to j_max - 1 do
 T[1, j] := T[2, j] - α[g]·Δx :
 T[i_max, j] := T[i_max - 1, j] + α[d]·Δx :
     for i from 2 to i_max - 1 do
                   Eq[k] := T[i + 1, j + 1] + T[i + 1, j - 1] + T[i - 1, j + 1]
   + T[i - 1, j - 1] + 2·(5 - β^2)/(1 + β^2)·(T[i + 1, j] + T[i - 1, j]) + 2·(5· β^2 - 1)/(1 + β^2)
   ·(T[i, j + 1] + T[i, j - 1]) - 20·T[i, j] = 0 :
     Temps[k] := T[i, j] :
     k := k + 1 :
     end do
end do:
```

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

$$T_{3,3} + 600 + 5\,T_{2,3} + 4\,T_{3,2} - 16\,T_{2,2} = 0$$
$$5\,T_{3,3} + 600 + T_{2,3} - 16\,T_{3,2} + 4\,T_{2,2} = 0$$
$$240 + T_{3,2} + 5\,T_{2,2} + 4\,T_{3,3} - 16\,T_{2,3} = 0$$
$$240 + 5\,T_{3,2} + T_{2,2} - 16\,T_{3,3} + 4\,T_{2,3} = 0 \quad \textbf{(1.9)}$$

```
> N := k - 1;
```

$$N := 4 \quad \textbf{(1.10)}$$

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

$$Eqs := \{240 + T_{3,2} + 5\,T_{2,2} + 4\,T_{3,3} - 16\,T_{2,3} = 0, 240 + 5\,T_{3,2} + T_{2,2} - 16\,T_{3,3} + 4\,T_{2,3} = 0, T_{3,3} + 600 + 5\,T_{2,3} + 4\,T_{3,2} - 16\,T_{2,2} = 0, 5\,T_{3,3} + 600 + T_{2,3} - 16\,T_{3,2} + 4\,T_{2,2} = 0\} \quad \textbf{(1.11)}$$

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

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

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

$$SolT := [[T_{2,2} = 80, T_{3,2} = 80, T_{2,3} = 60, T_{3,3} = 60]] \quad \textbf{(1.13)}$$

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

$$Eqs := [T_{3,3} + 600 + 5\,T_{2,3} + 4\,T_{3,2} - 16\,T_{2,2} = 0, 5\,T_{3,3} + 600 + T_{2,3} - 16\,T_{3,2} + 4\,T_{2,2} = 0, 240 + T_{3,2} + 5\,T_{2,2} + 4\,T_{3,3} - 16\,T_{2,3} = 0, 240 + 5\,T_{3,2} + T_{2,2} - 16\,T_{3,3} + 4\,T_{2,3} = 0] \quad \textbf{(1.14)}$$

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

(1.15)

$$M, R := \begin{bmatrix} -16 & 4 & 5 & 1 \\ 4 & -16 & 1 & 5 \\ 5 & 1 & -16 & 4 \\ 1 & 5 & 4 & -16 \end{bmatrix}, \begin{bmatrix} -600 \\ -600 \\ -240 \\ -240 \end{bmatrix} \tag{1.15}$$