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

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> restart : with(LinearAlgebra) :
> L := 30; H := 30; ndx := 3; ndy := 3;
```

$$L := 30$$
$$H := 30$$
$$ndx := 3$$
$$ndy := 3 \qquad (1.1)$$

```
> Tb := 100; Th := 40; α[g] := 10; α[d] := 20
```

$$Tb := 100$$
$$Th := 40$$
$$\alpha_g := 10$$
$$\alpha_d := 20 \qquad (1.2)$$

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

$$\Delta x := 10$$
$$\Delta y := 10$$
$$\beta := 1 \qquad (1.3)$$

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

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

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

$$N := 4 \qquad (1.5)$$

(1.6)

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

$$T_{1,1} := 100$$
$$T_{2,1} := 100$$
$$T_{3,1} := 100$$
$$T_{4,1} := 100 \qquad (1.7)$$

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

$$T_{1,4} := 40$$
$$T_{2,4} := 40$$
$$T_{3,4} := 40$$
$$T_{4,4} := 40 \qquad (1.8)$$

```
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;
```

$$T_{3,3}+100+5\,T_{2,3}+4\,T_{3,2}-16\,T_{2,2}=0$$
$$5\,T_{3,3}+1600+T_{2,3}-16\,T_{3,2}+4\,T_{2,2}=0$$
$$-260+T_{3,2}+5\,T_{2,2}+4\,T_{3,3}-16\,T_{2,3}=0$$
$$1240+5\,T_{3,2}+T_{2,2}-16\,T_{3,3}+4\,T_{2,3}=0 \tag{1.9}$$

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> N := k - 1;
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$$N := 4 \tag{1.10}$$

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

$$Eqs := \{-260+T_{3,2}+5\,T_{2,2}+4\,T_{3,3}-16\,T_{2,3}=0,\ 1240+5\,T_{3,2}+T_{2,2}-16\,T_{3,3}+4\,T_{2,3}=0,\ T_{3,3}+100+5\,T_{2,3}+4\,T_{3,2}-16\,T_{2,2}=0,\ 5\,T_{3,3}+1600+T_{2,3}-16\,T_{3,2}+4\,T_{2,2}=0\} \tag{1.11}$$

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

$$Tmps := [T_{2,2}, T_{3,2}, T_{2,3}, T_{3,3}] \tag{1.12}$$

```
> SolT := solve(Eqs, Tmps);
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$$SolT := \left[\left[T_{2,2}=\frac{1795}{24},\ T_{3,2}=\frac{4045}{24},\ T_{2,3}=\frac{1315}{24},\ T_{3,3}=\frac{3565}{24}\right]\right] \tag{1.13}$$

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

$$Eqs := [T_{3,3}+100+5\,T_{2,3}+4\,T_{3,2}-16\,T_{2,2}=0,\ 5\,T_{3,3}+1600+T_{2,3}-16\,T_{3,2}+4\,T_{2,2}=0,\ -260+T_{3,2}+5\,T_{2,2}+4\,T_{3,3}-16\,T_{2,3}=0,\ 1240+5\,T_{3,2}+T_{2,2}-16\,T_{3,3}+4\,T_{2,3}=0] \tag{1.14}$$

```
> M, R := GenerateMatrix(Eqs, Tmps)
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(1.15)

$$M, R := \begin{bmatrix} -16 & 4 & 5 & 1 \\ 4 & -16 & 1 & 5 \\ 5 & 1 & -16 & 4 \\ 1 & 5 & 4 & -16 \end{bmatrix}, \begin{bmatrix} -100 \\ -1600 \\ 260 \\ -1240 \end{bmatrix} \tag{1.15}$$