```
ClearAll[A1, x1, A2, x2]

Sa = Sin[30 Degree]
Ca = Cos[30 Degree]
L2 = 100
L1 = L2 * Ca
Ym = 21 000
Hatf = 23.5
P = 100

GT = {{-1, 0}, {-Ca, Sa}}
G = Transpose[GT]

q = {0, P}

F = DiagonalMatrix[{L1 / Ym / A1, L2 / Ym / A2}]

s = -Inverse[G].q
v = -Inverse[GT].F.s
```

$\dfrac{1}{2}$

$\dfrac{\sqrt{3}}{2}$

100

$50\sqrt{3}$

21 000

23.5

100

$\left\{\{-1, 0\}, \left\{-\dfrac{\sqrt{3}}{2}, \dfrac{1}{2}\right\}\right\}$

$\left\{\left\{-1, -\dfrac{\sqrt{3}}{2}\right\}, \left\{0, \dfrac{1}{2}\right\}\right\}$

$\{0, 100\}$

$\left\{\left\{\dfrac{1}{140\sqrt{3}\ A1}, 0\right\}, \left\{0, \dfrac{1}{210\ A2}\right\}\right\}$

$\left\{100\sqrt{3}, -200\right\}$

$\left\{\dfrac{5}{7\ A1}, \dfrac{5\sqrt{3}}{7\ A1} + \dfrac{40}{21\ A2}\right\}$

```
uhat = Hatf L1 / Ym
A1hat = s[[1]] / Hatf
A2hat = Abs[s[[2]] / Hatf]
A2Ehat = Sqrt[4 Abs[s[[2]]] L2^2 / Ym / Pi]

NMinimize[{A1 Ca + A2, A1 ≥ A1hat, A2 ≥ Max[A2hat, A2Ehat],
   v[[1]] ≤ uhat, v[[2]] ≤ uhat, A1 ≥ 0, A2 ≥ 0}, {A1, A2}]
```

0.0969124

7.37043

8.51064

$$40 \sqrt{\frac{5}{21\,\pi}}$$

NMinimize::incst : NMinimize was unable to generate any initial points satisfying the inequality constraints

$$\left\{-0.0969124 + \frac{5}{7\,A1} \le 0,\ -0.0969124 + \frac{5\sqrt{3}}{7\,A1} + \frac{40}{21\,A2} \le 0\right\}.$$ The initial region specified may not contain any

feasible points. Changing the initial region or specifying explicit initial points may provide a better solution. ≫

{60.1918, {A1 → 29.7872, A2 → 34.3953}}

```
p1 = ContourPlot[A1 Ca + A2, {A1, 0, 50}, {A2, 0, 50},
    ContourShading → None, FrameLabel → Automatic, ContourLabels → True];
p2 = ContourPlot[A1 Ca + A2 == 60.191836299658405, {A1, 0, 50},
    {A2, 0, 50}, ContourStyle → {Green, Thick}];
p3 = ContourPlot[{A1 == A1hat, A2 == A2hat, A2 == A2Ehat},
    {A1, 0, 50}, {A2, 0, 50}, ContourStyle → Red ];
```

$$p4 = \text{ContourPlot}\left[\frac{5\sqrt{3}}{7\,A1} + \frac{40}{21\,A2}, \{A1, 0, 50\}, \{A2, 0, 50\},\right.$$

```
    ContourShading → None, FrameLabel → Automatic, ContourLabels → True];
```

$$p5 = \text{ContourPlot}\left[\frac{5\sqrt{3}}{7\,A1} + \frac{40}{21\,A2} == 0.0969123666139729, \{A1, 0, 50\},\right.$$

```
    {A2, 0, 50}, ContourStyle → {Black, Thick}];
p6 = ContourPlot[{A1 == 29.78723490574166, A2 == 34.39533416279156},
    {A1, 0, 50}, {A2, 0, 50}, ContourStyle → {Blue }];
Show[p1, p2, p3, p4, p5, p6]
```