10-13_Plane_Wall_with_Convection_Animation

October 13, 2023

[1]:
```
import matplotlib.pyplot as plt
import numpy as np
%matplotlib inline
```

[2]:
```
from matplotlib.animation import FuncAnimation
from IPython import display
```

[3]:
```
L = 0.1 / 2
rho = 7830
c = 550
k = 48
Ti = 200
Tinf = 800
h = 250
tf = 2000
alpha = k / (rho * c)
```

[4]:
```
x = np.atleast_2d(np.linspace(-L, L))
t = np.atleast_2d(np.linspace(0, tf, 100)).T
```

[5]:
```
x_star = x / L
Fo = alpha * t / L**2
```

[6]:
```
Bi = h * L / k
print(Bi)
```

```
0.2604166666666667
```

[7]:
```
zeta1 = 0.4801
C1 = 1.0382
```

[8]:
```
theta_star = C1 * np.exp(-zeta1**2 * Fo) * np.cos(zeta1 * x_star)
```

[9]:
```
T = theta_star * (Ti - Tinf) + Tinf
```

[10]:
```
# plt.tight_layout()
fig, ax = plt.subplots(figsize=(8,4))
```

```
line, = ax.plot([])
text = ax.text(0.7 * L, Ti + 0.1 * (Tinf - Ti), "")
ax.set_xlim(-L, L)
ax.set_ylim(Ti, T.max())
ax.set_xlabel("x (m)")
ax.set_ylabel("T (C)")

def update_plot(frame):
  line.set_data((x, T[frame, :]))
  text.set_text("t={:>4} s".format(int(t.flatten()[frame])))

anim = FuncAnimation(
  fig,
  update_plot,
  frames=len(t),
  interval=50,
)
video = anim.to_html5_video()
html = display.HTML(video)
display.display(html)
plt.close();
```

```
<IPython.core.display.HTML object>
```

[ ]: