

# 1 Advection

## 1.1 advect1-t

- *advect1-t.i*
- 1D generated mesh with libmesh
- Uses DG Kernels
- InflowBC and OutflowBC
- Transient problem

Figure 1 shows the results. Advects BC. It seems like the variable has to be a CONSTANT MONOMIAL.

$$\frac{\partial}{\partial t}\rho + v \frac{\partial}{\partial x}\rho = 0 \quad (1)$$

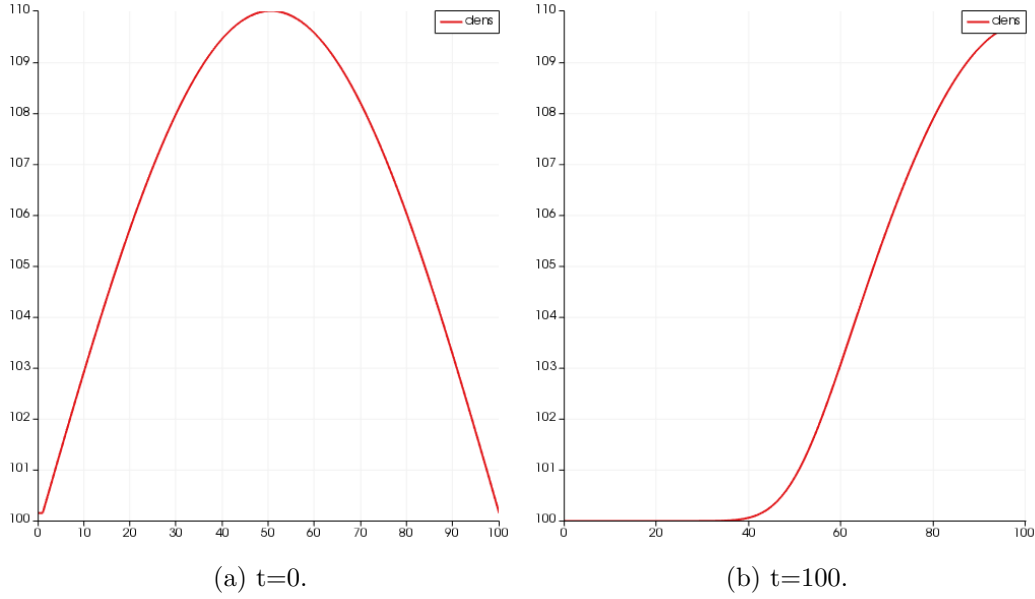


Figure 1: Advected density.

## 1.2 periodic\_bc2

- *moose/examples/ex04-bcs/periodic\_bc2.i*
- 1D generated mesh with libmesh
- Periodic BCs
- Transient problem

In *advect1-t-bc.i* I tried to add periodicBCs to the previous problem and it does not work. Here I tried to isolate the problem. Figure 2 shows the results. It does not work if the variable is a CONSTANT MONOMIAL. It works if the variable is FIRST order (either MONOMIAL or LAGRANGE).

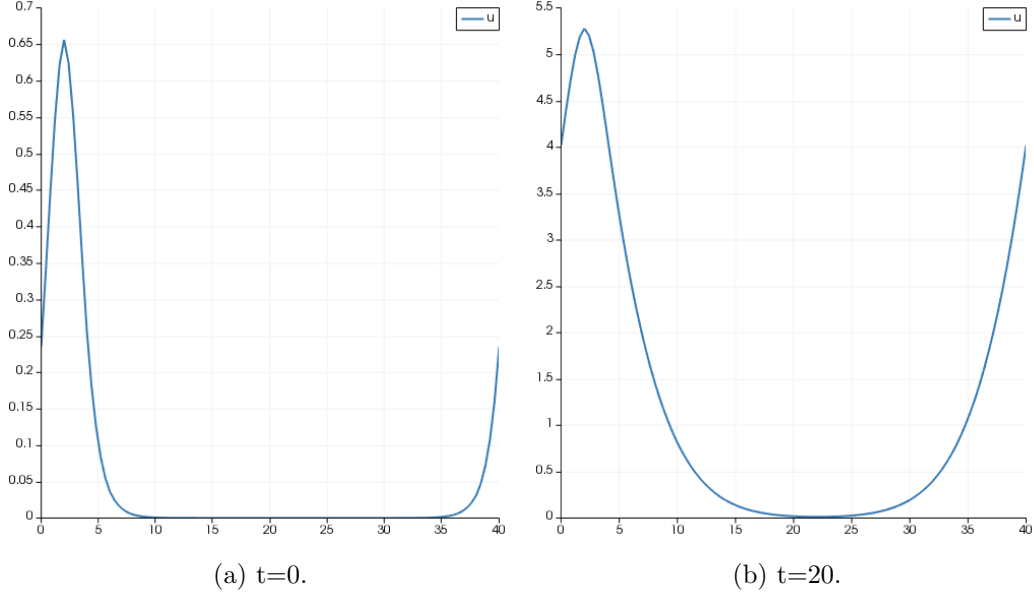


Figure 2: Periodic BCs.

### 1.3 advect2-t

- *advect2-t.i*
- 1D generated mesh with libmesh
- Uses DG Kernels
- TemperatureInflowBC and TemperatureOutflowBC
- Transient problem

Very similar to *advect1-t.i*. Adds volumetric source. Figure 3 shows the results. It is correct.  
 $\rho(L, t \rightarrow \infty) - \rho(0, t) = q/v * L = 200$

$$\frac{\partial}{\partial t}\rho + v \frac{\partial}{\partial x}\rho = \dot{q} \quad (2)$$

- IC:  $\rho(x, 0) = 100 + 10\sin(\frac{\pi}{L}x)$
- BC:  $\rho(0, t) = 100$
- $v = 0.5$
- $L = 100$
- $q = 1$

### 1.4 advect2-ss

- *advect2-ss.i*
- 1D generated mesh with libmesh

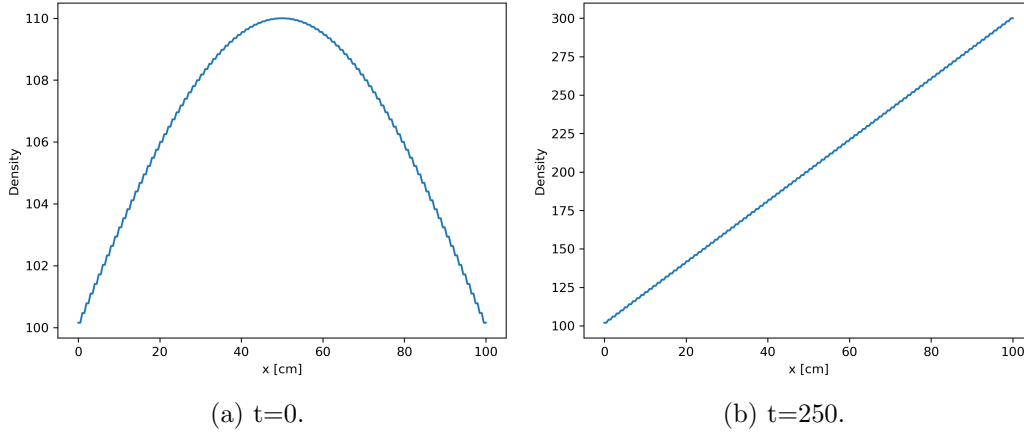


Figure 3: Advected density with volumetric source.

- Uses DG Kernels
- Inflow and OutflowBC
- Steady problem

Same as *advec2-t* but steady state. Figure 4 shows the results. It is correct.  $\rho(L) - \rho(0) = q/v * L = 200$

$$v \frac{\partial}{\partial x} \rho = \dot{q} \quad (3)$$

- BC:  $\rho(0, t) = 100$
- $v = 0.5$
- $L = 100$
- $q = 1$

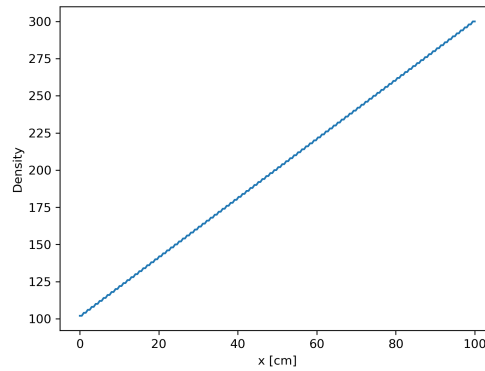


Figure 4: Steady state solution.

## 1.5 advect3-t

- *advect3-t.i*
- 1D generated mesh with libmesh
- Uses DG Kernels
- TemperatureInflowBC and TemperatureOutflowBC
- Transient problem

Very similar to *advect1-t.i*. Solves for the temperature advection equation. Advects BC. Figure 5 shows the results.

$$\rho c_p \frac{\partial}{\partial t} T + \rho c_p v \frac{\partial}{\partial x} T = 0 \quad (4)$$

- BC:  $T(0, t) = 930$
- IC:  $T(x, 0) = 930$
- $\rho = 1e-2$
- $c_p = 2e3$
- $v = 0.5$
- $L = 100$

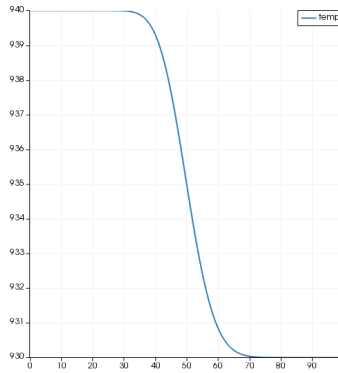


Figure 5: Advects BC.

## 1.6 advect4-t

- *advect4-t.i*
- 1D generated mesh with libmesh
- Uses DG Kernels
- TemperatureInflowBC and TemperatureOutflowBC
- Transient problem

Similar to *advec4-t.i* Adds a point source and solves for temperature. Figure 6 shows the results. It is correct.  $T(L) - T(0) = q/(\rho c_p v) * L = 10$

$$\rho c_p \frac{\partial}{\partial t} T + \rho c_p v \frac{\partial}{\partial x} T = \dot{q} \quad (5)$$

- BC:  $T(0, t) = 930$
- IC:  $T(x, 0) = 930$
- $\rho = 1e-2$
- $c_p = 2e3$
- $v = 0.5$
- $L = 100$
- $q = 1$

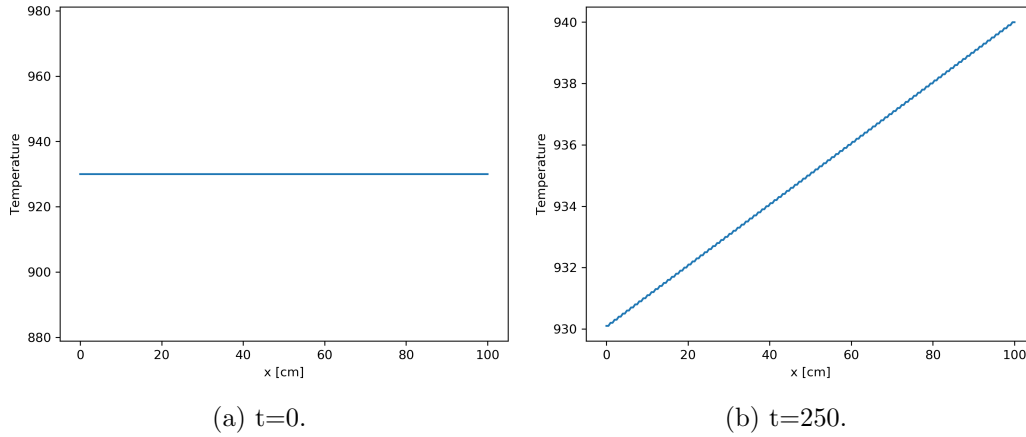


Figure 6: Advected temperature with volumetric source.

## 1.7 advec5-t

- *advec5-t.i*
- pseudo-1D: 2D-coolant.msh
- Uses DG Kernels
- TemperatureInflowBC and TemperatureOutflowBC
- Transient problem

Similar to *advec5-t.i* but has a  $q''$  on the wall. Figure 7 shows the results.

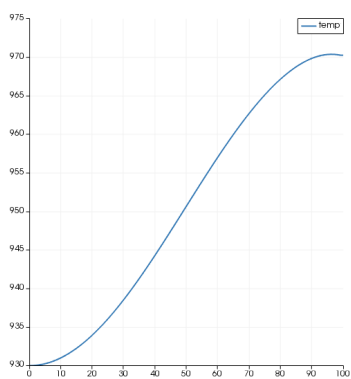


Figure 7: Advects temperature while wall is been heated.