Brooks Karlik

April 29, 2022

$$F^* = F^* - \alpha h^2 \rho \, \text{abs}\left(\frac{\partial u}{\partial x}\right) \frac{\partial u}{\partial x} \begin{bmatrix} 0 \\ 1 \\ u \end{bmatrix}$$

Take the following code for LF method with two identical methods of solving for q: one with slicing, and one with raw indexing. The output for the following code is in .

```julia
function solver_step!(method::LaxFriedrichs, q::Matrix{T}, F::Matrix{T}, dt::T, h::T, _...) where T <:
AbstractFloat
    # TODO: Lax Freidrichs method
    # according to the paper
    n = size(q)[2]

    for j = 2:n-1
        q[:, j] = (1/2) * (q[:, j+1] + q[:, j-1]) - (dt / (2h)) *( F[:, j+1] - F[:, j-1])
    end

    #q[:, 2:n-1] = (1/2) * (q[:, 3:n] + q[:, 1:n-2]) - (dt / (2h)) *( F[:, 3:n] - F[:, 1:n-2])
end
```

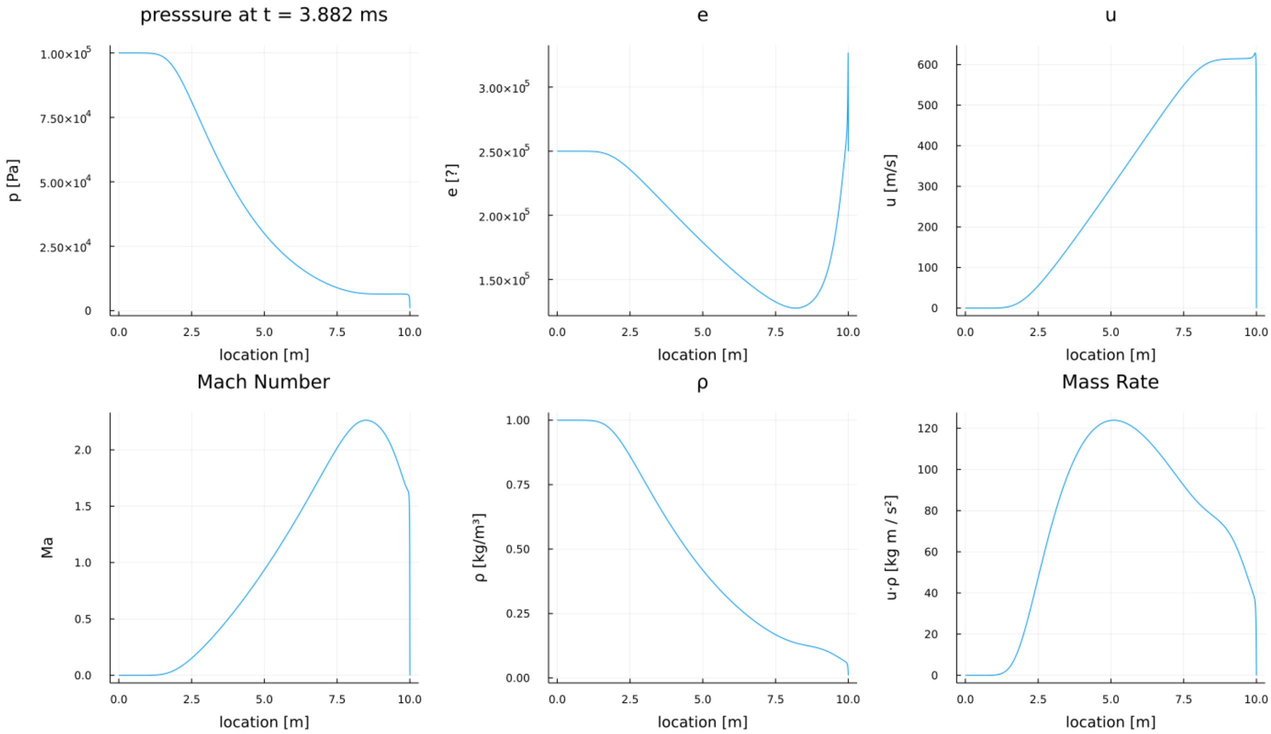

Figure 1: top statement only results

If we comment out the top statement and only run the bottom statement the results are in figure 2

```
function solver_step!(method::LaxFriedrichs, q::Matrix{T}, F::Matrix{T}, dt::T, h::T, _...) where T <:
AbstractFloat
    # TODO: Lax Freidrichs method
    # according to the paper
    n = size(q)[2]

    #for j = 2:n-1
    #   q[:, j] = (1/2) * (q[:, j+1] + q[:, j-1]) - (dt / (2h)) *( F[:, j+1] - F[:, j-1])
    #end

    q[:, 2:n-1] = (1/2) * (q[:, 3:n] + q[:, 1:n-2]) - (dt / (2h)) *( F[:, 3:n] - F[:, 1:n-2])
end
```

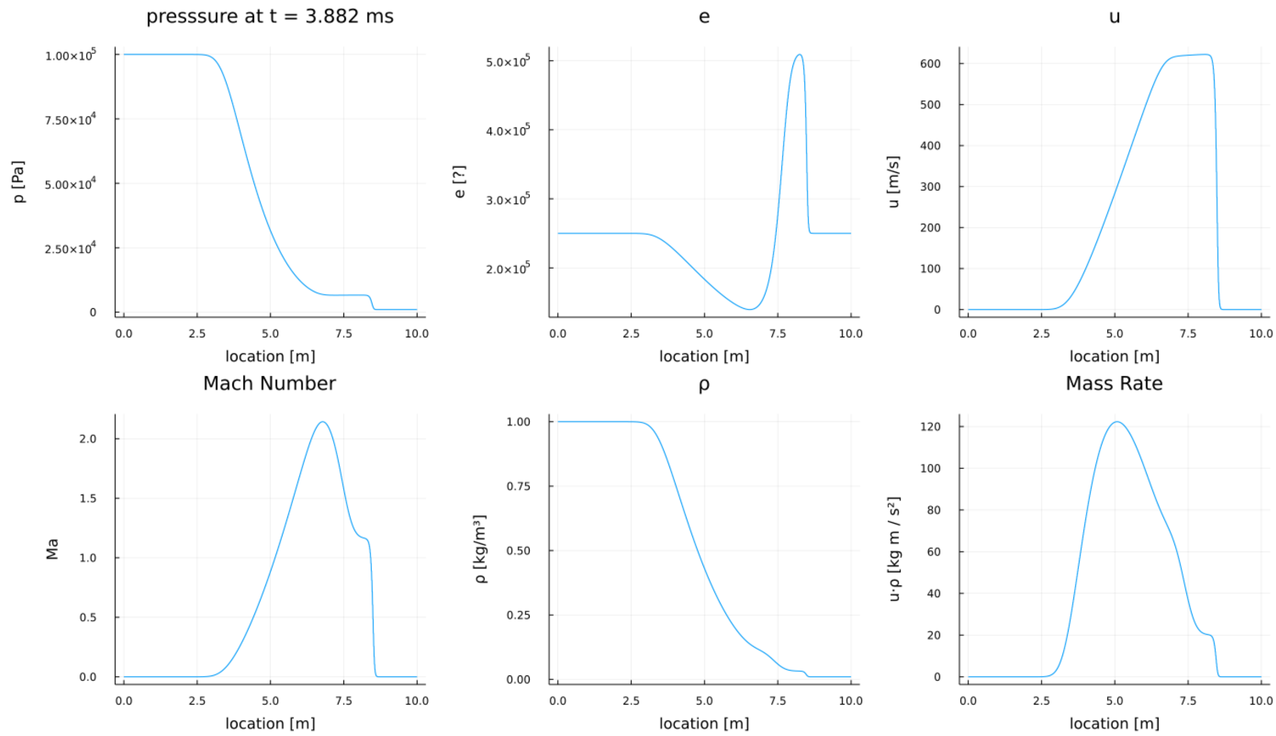

Figure 2: bottom statement only results

If we run both statements, the result is in figure 3.

```
function solver_step!(method::LaxFriedrichs, q::Matrix{T}, F::Matrix{T}, dt::T, h::T, _...) where T <:
AbstractFloat
    # TODO: Lax Freidrichs method
    # according to the paper
    n = size(q)[2]

    for j = 2:n-1
        q[:, j] = (1/2) * (q[:, j+1] + q[:, j-1]) - (dt / (2h)) *( F[:, j+1] - F[:, j-1])
    end

    q[:, 2:n-1] = (1/2) * (q[:, 3:n] + q[:, 1:n-2]) - (dt / (2h)) *( F[:, 3:n] - F[:, 1:n-2])
end
```

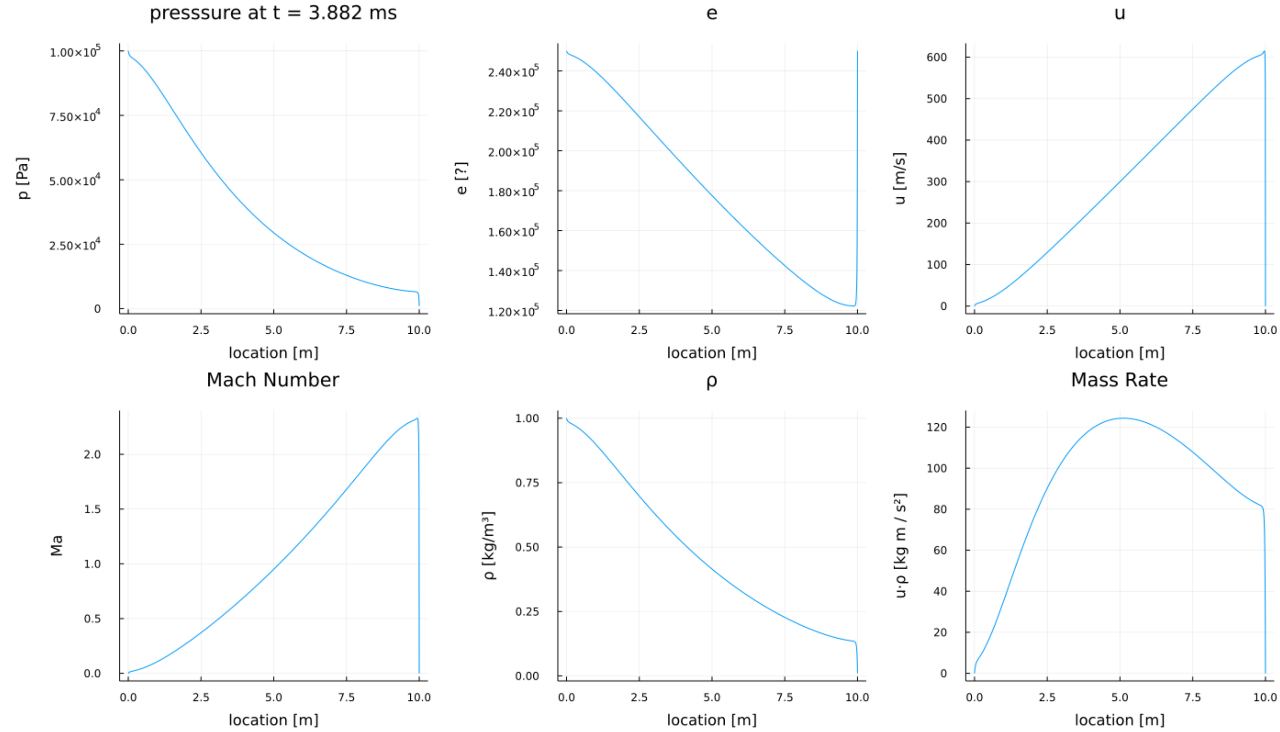

Figure 3: both statements results