Ditto: experimenting with Moose framework

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# Mathematical Identities

## Continuity equation:



where the first term is the rate of change of *c*, **j** is the flux and *R* the source/sink term for *c*.

## Moose inner product notation:





## Integration by parts and divergence theorem

Let *ψ* be a scalar variable and **u** a vector function. The divergence of their produce is:



By integrating over a domain Ω and rearranging we get:



The divergence theorem transforms a volume integral into a surface integral:



with being an outward normal vector on surface **. By combining eqs and we get:



# How to create a the Ditto moose project

1. Activate moose

conda activate moose

2. Generate the project files w/ stork

cd ~/projects

./moose/scripts/stork.sh Ditto

3. (Optional) Create GitHub repo called Ditto and push the project

cd ~/projects/Ditto

git remote add origin [git@github.com:[insert\_name]/Ditto.git](mailto:git@github.com:[insert_name]/Ditto.git)

git push -u origin main

4. Make the executable

make –j4 # e.g., with 4 processors

5. Run the tests

./run\_tests

6. Generate a problems folder

mkdir problems

# Examples

## Diffusion (steady)

We will generate a script for steady diffusion in 2D using the Dirichlet boundary conditions *u*left = 1 and *u*right = 0.

Let’s derive the weak form in inner product notation:

Strong form:



Multiply with a test function *ψ* and integrate over the domain



Integrate the first term by parts and apply the divergence theorem (eq. with **u** → ):



Expressing in the inner product notation:



We will set the domain to from -10, +10 along the *x* and *y* directions.

The problems is solved with the script ex01\_diffusion.i and runs with the command:

./run.sh ex01\_diffusion.i

Paraview output:

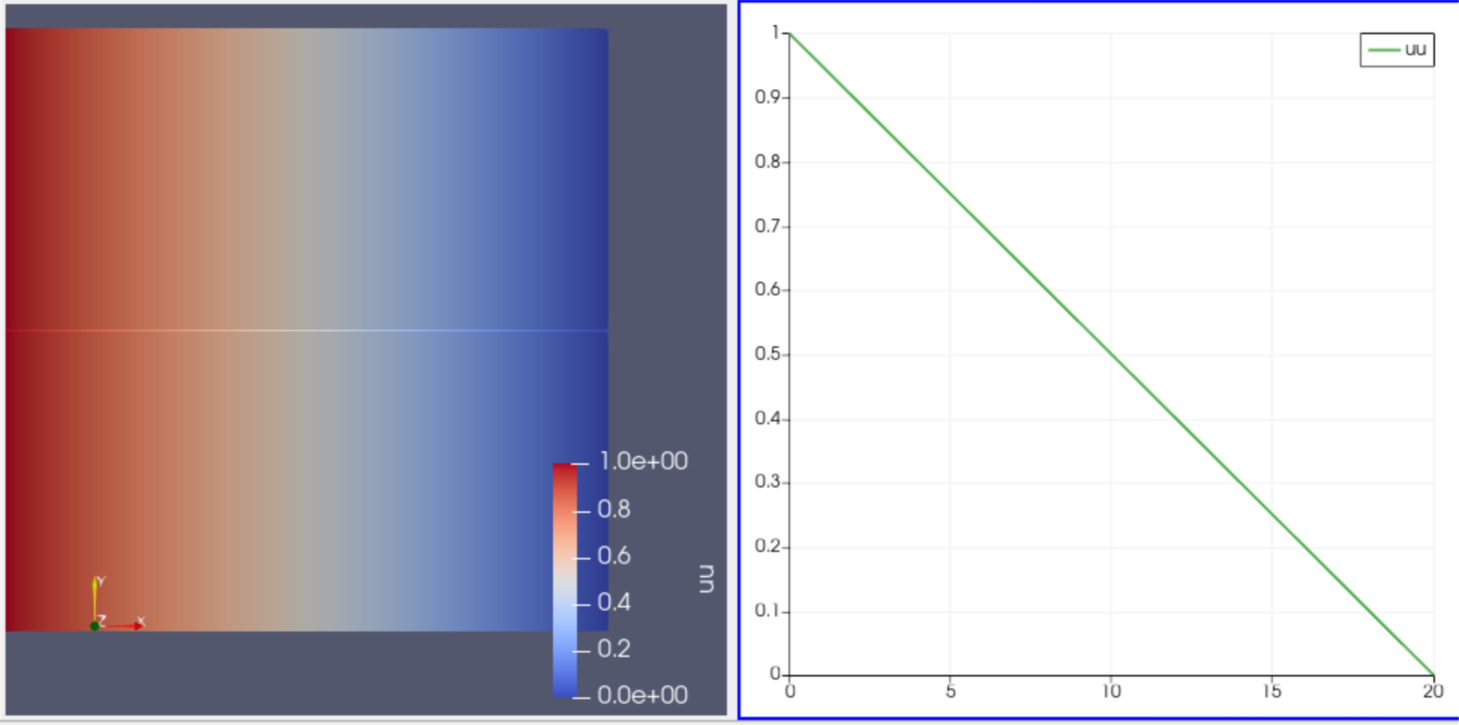


Figure 1. output from exodus file ex01\_diffusion\_out.e