

Here is an example of applying the heat equation over a simple mixed dimensional mesh. Next step will be showing that the mesh is a topologically stratified space.

Here is the mesh:

INSERT PICTURE OF THE LINE AND SQUARE

The heat equation for the rod $u(x, t)$ is as follows:

$$\alpha_1 \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$$

The boundary conditions will be as follows:

$$u(0, t) = 0$$

$$u(3, t) = 0$$

$$u(x, 0) = -5x(x - 3)$$

The square will have a separate heat equation $v(x, y, t)$. Here is the square's diffusion equation:

$$\alpha_2 \left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \right) = \frac{\partial v}{\partial t}$$

The boundary condition on the square will be the values at the rod. Here are all of its boundary conditions