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Visualization of ideal gas flow in a porous medium: broken axial symmetry

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Landfills are the most common method of waste management. As solid waste decomposes and compresses, more layers can be added. During decomposition, gases including methane and carbon dioxide are released via the anerobic decomposition of solid material. Methane in high enough concentrations is explosive, flammable, toxic, and it is one of the major contributors to greenhouse gases. Therefore, it is very important to have the means to collect these gases in the most effective way possible.

Modern landfills utilize gas wells, which are imbedded in the waste to collect the gas. However, due to certain peculiarities of the flow through porous media, they are very difficult to monitor. By using ideal gas flow solutions, it is possible to map the gas movement around the wells. These solutions exist for several configurations including two equal sectors, two unequal sectors and 3 or more sectors, each with distinct permeabilities.

Due to the nature of the solutions, traditional methods of visualizing data are inadequate. Therefore, two programs, Octave and VU, will be paired in order to effectively visualize the gas flow for various configurations. Then a custom code will be developed for each visualization type with Octave.

Current practices rely on decades of experience; however, there is no mathematical analysis readily available. These generic algorithms will allow for a deeper understanding of the gas movement surrounding landfill wells. More importantly, designers and operators will use them to build and manage landfills with efficiency and minimal environmental impacts.