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# NUMERICAL SIMULATION OF IMPREGNATION IN POROUS MEDIA BY SELF-ORGANIZED GRADIENT PERCOLATION METHOD

**A.K. Nguyen[1,2*], E. Blond[1], T. Sayet[1], A. Batakis[2], E. De Bilbao[3] and M.D. Duong[4]**

[1] Univ. Orléans, Univ. Tours, INSA CVL, LaMé, Orléans 45000, France,
{anh-khoa.nguyen, eric.blond, thomas.sayet}@univ-orleans.fr

[2] Univ. Orléans, Institut Denis Poisson, UMR CNRS 6628, Av. De Blois, Orléans 45000, France,
athanasios.batakis@univ-orleans.fr and http://www.univ-orleans.fr/mapmo/membres/batakis/

[3]Univ.Orléans, CEMHTI, UPR CNRS 3079, Av. rech. Scientifique, Orléans 45072, France,
emmanuel.debilbao@univ-orleans.fr and http://www.cemhti.cnrs-orleans.fr

[4] University of Science, Ho Chi Minh city, 227 Nguyen Van Cu, Vietnam,
dmduc@hcmus.edu.vn and http://web.hcmus.edu.vn/en/index.php

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The aim of this work is to develop a new numerical method to overcome the computational difficulties of numerical simulation of unsaturated impregnation in porous media. The numerical analysis by classical methods (F.E.M, theta-method, …) for this phenomenon require small time-step and space discretization to ensure both convergence and accuracy. Yet this leads to a high computational cost. Moreover, a very small time-step can lead to spurious oscillations that impact the precision of the results [1]. Thus, we propose to use a Self-organized Gradient Percolation (SGP) algorithm to reduce the computational cost and overcome these numerical drawbacks.

The (SGP) method is based on gradient percolation theory [2], relevant to calculation of local saturation. The initialization of this algorithm is driven by an analytic solution of the homogenous diffusion equation, which is a convolution between a Probability Density Function (PDF) and a smoothing function [3]. Thus, we propose to reproduce the evolution of the capillary pressure profiles by the evolution of the standard deviation of the PDF.

This algorithm is validated by comparing the results with the capillary pressure profiles and the mass gain curve obtained by finite element simulations and experimental measurements, respectively. The computational time of the proposed algorithm is lower than that of finite element models for one-dimension case. In conclusion, the SGP method permits to reduce the computational cost and does not produce spurious oscillations. The work is still going on for extension in 3D and the first results are promising.

## REFERENCES

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