

Accepted Manuscript

The Method of Quasiperiodic Fields for Diffusion in Periodic Porous Media

François Mathieu-Potvin

PII: S1385-8947(16)30852-X
DOI: <http://dx.doi.org/10.1016/j.cej.2016.06.045>
Reference: CEJ 15355

To appear in: *Chemical Engineering Journal*

Received Date: 11 March 2016
Revised Date: 1 June 2016
Accepted Date: 8 June 2016



Please cite this article as: F. Mathieu-Potvin, The Method of Quasiperiodic Fields for Diffusion in Periodic Porous Media, *Chemical Engineering Journal* (2016), doi: <http://dx.doi.org/10.1016/j.cej.2016.06.045>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

**THE METHOD OF QUASIPERIODIC FIELDS
FOR DIFFUSION IN PERIODIC POROUS MEDIA**

François **Mathieu-Potvin***

(**bold** font weight for family name)

*Department of Mechanical Engineering, 1065, Avenue de la Médecine, Université Laval,
Quebec City, Quebec, Canada, G1V 0A6*

Abstract

In this paper, a new theoretical method for smoothing the diffusion equation in periodic porous media is presented. That strategy is named ‘the method of quasiperiodic fields’ because it is based on the postulate that the concentration is a quasiperiodic field throughout the porous medium. The method proceeds in four steps: (i) a first level averaging of the diffusion equation, (ii) the statement of a quasiperiodic problem, (iii) the statement of factorized quasiperiodic problems, and (iv) the development of a closed form for the averaged diffusion equation. A first application of these four steps on the initial diffusion equation in a periodic porous medium provides an averaged diffusion equation in which the effective diffusion coefficient varies periodically at the small scale. A second application of the four steps provides a smoothed diffusion equation in which the effective diffusion coefficient is constant. The final smoothed diffusion equation is stated in terms of the double average of the concentration field.

Keywords: Porous Media, Diffusion, Volume Averaging, Quasiperiodic Field.

* **Corresponding author :**

François Mathieu-Potvin, ing. jr, Ph. D.

Professor in the Department of Mechanical Engineering

1065, Avenue de la Médecine, Université Laval, Quebec City, Province of Quebec, Canada, G1V0A6

Tel.: 1-418-656-2131 x 5409

Fax.: 1-418-656-7415

Email: Francois.Mathieu-Potvin@gmc.ulaval.ca

Download English Version:

<https://daneshyari.com/en/article/6581494>

Download Persian Version:

<https://daneshyari.com/article/6581494>

[Daneshyari.com](https://daneshyari.com)