



# Solving Population Balance Equations via Auto-Correlation Functions of Compact Supported Wavelets

Amjad Alipanah

*Department of Mathematics, Faculty of Sciences, University of Kurdistan, Sanandaj, Iran  
e-mail: a.alipanah@uok.ac.ir*

## Abstract

Analytical solution of population balance equation is difficult due to their nonlinear and integral-differential nature and requires efficient numerical methods. In this paper, a numerical method based on auto-correlation functions of compactly supported Daubechies wavelet is presented to solve the population balance differential equation. Here, two special forms of population balance equation including a differential equation and an integro-differential equation are approximated by using auto-correlation functions of Daubechies wavelet. Also, by using the interpolation property of auto-correlation functions, the necessary derivatives and integrals can be approximated with high accuracy. Since approximation matrix derivative of these functions is ill conditioned matrix, for areas near the boundary, Lagrange interpolation is used. This method solves the two main forms of population balance equation as linear systems by using recursive algorithms and matrix structure. The obtained numerical results, compared to existing methods, show a significant improvement in the accuracy and stability of calculations.

**Keywords:** Population balance equations, Daubechies wavelets, auto-correlation functions, integro-differential equations, differential equations, recursive algorithms.