Advances in Mathematical Sciences and Applications
Vol. 34, No. 1 (2025), pp. 253–269

GAKKOTOSHO
TOKYO JAPAN

AN EFFECTIVE NUMERICAL METHOD BASED ON VARIATIONAL APPROACH TO COMPUTE THE RADIAL APPROXIMATIONS OF EPITAXIAL GROWTH MODEL

Pratikshya Manini

Center of Data Sciences, Siksha 'O' Anusandhan, ITER College, Odisha, 751019, India.
(E-mail: pratikshyamanini@gmail.com)

Biswajit Pandit

Center of Data Sciences, Siksha 'O' Anusandhan, ITER College, Odisha, 751019, India.
(E-mail: biswajitpandit82@gmail.com)

and

Ravi P. Agarwal *

Department of Mathematics and Systems Engineering, Florida Institute of Technology, Melbourne, FL 32901, USA.
(E-mail: agarwalr@fit.edu)

Abstract. The objective of this study is to investigate the numerical solution of the non-self-adjoint singular boundary value problems that occur in the theory of epitaxial growth. Not every method can capture all of the solutions because the suggested problem has multiple solutions. In the present work, both solutions will be calculated numerically by developing an iterative method based on variational approach. In the process of determining the numerical approximations, it turns out that the value of a parameter completely determines whether the numerical approximations exist or not. For small values of this parameter, we find the numerical solutions, and there are no solutions for large values of the parameter. The suggested algorithm is quite efficient and is practically well suited for the use in such type of models. Some numerical examples are given to verify the efficiency and reliability of the suggested algorithm. We also compare our derived numerical results with the existing results.

Communicated by Editors; Received January 17, 2025
*Corresponding author
AMS Subject Classification: 34B16, 65F10, 34B27.
Keywords: Singular Boundary Value Problem, Variational Approach, Epitaxial Growth, Radial Solution.