

RANDOM COEFFICIENT DIFFERENTIAL MODELS OF GROWTH OF ANAEROBIC PHOTOSYNTHETIC BACTERIA*

DAN STANESCU[†], BENITO CHEN-CHARPENTIER[‡],
BRANDI J. JENSEN[§], AND PATRICIA J. S. COLBERG[¶]

Abstract. In many fields of science and engineering there are mathematical models given in terms of differential equations with random coefficients. The randomness is due to errors or uncertainty. Closed solutions are few, and usually numerical approximations need to be calculated. Polynomial chaos is a powerful method in this regard. Here we apply this method to several modeling approaches for the time evolution of photosynthetic bacterial populations. Usual methods used in microbiology are contrasted with approaches based on differential equations with random coefficients. Numerical results based on laboratory data for two different species of bacteria are presented.

Key words. bacterial growth models, random differential equations, curve fitting

AMS subject classifications. 60H25, 65C20, 92D25

*Received March 31, 2008. Accepted October 7, 2008. Published online March 31, 2009. Recommended by Godela Scherer.

[†]Department of Mathematics, University of Wyoming, Laramie, WY 82071 (stanescu@uwyo.edu).

[‡]Department of Mathematics, University of Texas at Arlington, Box 19408, 439 Pickard Hall, Arlington, TX 76019 (bmchen@uta.edu).

[§]Department of Zoology and Physiology, University of Wyoming, Laramie, WY 82071 (bjensen@uwyo.edu).

[¶]Department of Civil and Architectural Engineering, University of Wyoming, Laramie, WY 80271 (pczoo@uwyo.edu).