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BACTERIAL CHEMOTAXIS CONTROL ILLUSTRATES AN ENGINEERING FRAMEWORK IN THE CREATION MODEL

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ABSTRACT

This paper shows how biological design in bacteria chemotaxis control shows architectural design features that are found in many areas of biological life that reflect an engineering framework found in the creation model. The study highlights the bacteria chemotaxis control process utilizing the System Modeling Language (SysML) to leverage well-defined and proven engineering tools for architecting, analyzing, and refining complex systems. It first introduces SysML, and the advantages model-based systems engineering (MBSE) has for capturing system architecture and allowing for ongoing assessment of how biological system operates and the clarification of how much model detail is required to reveal a system element function. Then using SysML modeling methods, the chemotaxis control process is captured. Details of the chemotaxis control process are captured in SysML syntax instead of a biological syntax. This approach intentionally enables the analysis of the biological chemotaxis control system from an engineered system point of view. After the functional model is analyzed, the resulting insights and observations are discussed. The model can act as a scaffolding to help uncover system function, the relationship of system components and processes, and bioinformatic phenotype and genotype correlation.

KEYWORDS

Divine design, bacterial chemotaxis, control theory, systems engineering, system modeling language (sysml), systems biology, model-based systems engineering, engineering functional modeling

THE AUTHOR

James D. Johansen has an interdisciplinary Ph.D. from Liberty University, Lynchburg, VA, USA, in 2019, two master's degrees in science and religion, and Christian apologetics, from Biola University, La Mirada, CA, USA, in 2015 and 2012, and electrical engineering master's and bachelor's degrees from the University of Southern California, Los Angeles, CA, USA, in 1985 and 1982. He is an adjunct professor at Liberty University in their engineering and computational science department, an adjunct professor at the Master's University, Placentia, CA, USA, a researcher in theoretical biology, and an adjunct professor at Biola University, La Mirada, CA, USA, in their chemistry, physics, and engineering department, a part-time assistant professor at Azusa Pacific University in their engineering and computer science department, and an adjunct professor at Regent University in their graduate school. He has over two decades of experience in systems engineering at two federally funded research and development companies supporting the aerospace industry. He has over 20 conference papers and journal articles, plus a book chapter. He is a member of INCOSE, IEEE, MORS, ETS, CBS, and EPS professional societies.