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SYMPOSIUM

Analysis of Algorithms for Intensive Care Unit Blood Glucose Control

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Abstract

Intensive care unit (ICU) blood glucose control algorithms were reviewed and analyzed in the context of linear systems theory and classical feedback control algorithms. Closed-loop performance was illustrated by applying the algorithms in simulation studies using an *in silico* model of an ICU patient. Steady-state and dynamic input–output analysis was used to provide insight about controller design and potential closed-loop performance. The proportional-integral-derivative, columnar insulin dosing (CID, Glucommander-like), and glucose regulation for intensive care patients (GRIP) algorithms were shown to have similar features and performance. The CID strategy is a time-varying proportional-only controller (no integral action), whereas the GRIP algorithm is a nonlinear controller with integral action. A minor modification to the GRIP algorithm was suggested to improve the closed-loop performance. Recommendations were made to guide control theorists on important ICU control topics worthy of further study.

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Abbreviations: (CID) columnar insulin dosing, (GRIP) glucose regulation for intensive care patients, (ICU) intensive care unit, (IV) intravenous, (MPC) model predictive control, (PID) proportional-integral-derivative

Keywords: closed-loop glucose control, hyperglycemia, *in silico* model

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