

A REDUCED TYPE 1 DIABETES MODEL FOR MODEL PREDICTIVE CONTROL

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INTRODUCTION

Recently, a large-scale model (13 differential equations with 35 parameters) of the glucose-insulin system in type 1 diabetes has been developed [DallaMan et al IEEE Trans. Biomed. Eng. 2007, US Patent n° US2008 /067725] and found useful in *in silico* testing of closed-loop algorithms [Kovatchev et al JDST 2009]. However, in order to facilitate model predictive control implementation, a model with a lower order, but still physiologically-based, is desirable.

METHODS

The state space and parameter dimensions of the reduced model are almost halved with respect to the full model. The model describes glucose transit through the gastro-intestinal tract, glucose kinetics, insulin action on glucose production and utilization, plasma-to-interstitium glucose dynamics, subcutaneous and systemic insulin kinetics.

The model is identified in 11 type 1 diabetic subjects, studied in hospital for 3 days within the DIAdvisorTM (www.diadvisor.eu), from plasma glucose and insulin concentrations and interstitial glucose (CGM sensor).

RESULTS

The new model satisfactorily fits the data. Parameters are estimated with acceptable precision. Simulations are also performed to compare glucose and insulin profiles generated by the reduced model with those obtained by the full type 1 diabetes model.

CONCLUSIONS

The proposed model, albeit of lower order, well describes the major system behaviors and can easily be embedded within model predictive control algorithms.