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Option: **Advanced Automation**

Title:

**Design of an Optimal Digital PID Controller Based
On PSO Algorithm using Xilinx SysGen® for the
Regulation of Blood Glucose level for Diabetes**

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Appendix A

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الخلاصة:

تعد السيطرة علي مستوى السكر في الدم موضوعا هاما لمريض السكري من نوع 1

والهدف الرئيسي من هذا العمل يتجه إلي تصميم متحكم رقمي متناسب- متكامل - متمائل(بي إي دي) (PID) علي أساس خوارزميات حشد الجزيئات (PSO) للتحكم في نسبة السكر في الدم ولقد حققنا في هذا العمل.

أولاً: المتحكم (بي إي دي)تم اختياره باستعمال معادلات (Bergman Minimal model)كعملية(معالج) لدي مرضي السكري بمحاكاة برنامج ماتلاب وباستعمال طريقة التدوير للبحث عن المعاملات التي تتلاءم مع الدارة المغلقة للتحكم في نسبة السكر في الدم وتطبيق خوارزميات حشد الجزيئات للبحث عن أحسن المعاملات لأداء أمثل.

الهدف الثاني يتناول عملية تصميم مسيطر رقمي باستخدام تقنية مصفوفة بوابات المجال القابلة للبرمجة (FPGA)باستعمال المحاكاة ماتلاب واستعمال برنامج مايسمي بنظام التوليد(System Generator).

وفي الأخير قمنا بمقارنة مابين الطريقة الكلاسيكية ل(بي إي دي) وطريقة حشد الجزيئات وطريقة التصميم عن طريق مصفوفة بوابات المجال القابلة للبرمجة (FPGA).

الكلمات الدالة: مريض السكري من نوع1, السكر في الدم, خوارزميات حشد الجزيئات (PSO), متحكم رقمي(PID), مصفوفة بوابات المجال القابلة للبرمجة (FPGA), نظام التوليد(System Generator).محاكاة ماتلاب.

Abstract

The control of blood glucose is a significant topic for Type I diabetic patient.

The main goal of this Work is to design an optimal Digital Proportional-Integral Derivative (PID) Controller based on Particle Swarm Optimization (PSO) Algorithm For the regulation of blood glucose.

Firstly: The controller is tuned using Bergman Minimal model (plant)as a diabetic patient model in MATLAB and Simulink environment. The PID parameters are tuned using (PSO) Particle Swarm Optimization algorithm to determine parameters that meet closed loop system of the blood glucose regulation performance specification.

The second goal to describe the implementation of the Digital PID controller in FPGA devices using the Matlab Simulink environment using System Generator for DSP and setting timing parameters.

And Finally we compared between the classical (PID), (PSO-PID) And method designing by using Field Programming Gate Array(FPGA).

Keywords: type-I diabetic patients, blood glucose, Particle Swarm Optimization (PSO), Digital PID controller ,FPGA, Xilinx ISE design suite, System Generator, MATLAB/Simulink.

Résumé :

Le contrôle de la glycémie est un sujet important pour les patients diabétiques de TypeI. L'objectif principal de ce travail est de concevoir un contrôleur Proportionnel-Intégral dérivé (PID) numérique optimal pour la régulation de la glycémie en se basant sur l'algorithme d'essaim des particules (PSO).

Premièrement: le contrôleur est conçu en utilisant le modèle minimal de Bergman comme un modèle d'un patient diabétique dans les environnements MATLAB et Simulink. L'algorithme d'optimisation (PSO) est utilisé pour déterminer les paramètres du contrôleur PID qui répondent aux performances de régulation de la glycémie.

Le deuxième but est de décrire l'implémentation du contrôleur PID numérique dans les circuits FPGA en utilisant les environnements Simulink et System Generator de Matlab.

Et enfin, nous avons comparé entre le PID classique, le PSO-PID et la méthode de conception par l'utilisation du FPGA.

les mots clés : patients diabétiques de TypeI, la glycémie , l'algorithme d'essaim des particules (PSO), (PID) numérique, Xilinx System Generator de Matlab MATLAB/Simulink.

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General Introduction

