Using Interval Type-2 Fuzzy Controller for Diabetes Mellitus

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Abstract : In case of Diabetes Mellitus the controlling of insulin is very difficult. This illness is an incurable disease affecting millions of people worldwide. Glucose is a sugar which provides energy to the cells. Insulin is a hormone which supports the absorption of glucose. Fuzzy control strategy is attractive for glucose control because it mimics the first and second phase responses that the pancreas beta cells use to control glucose. We propose two control algorithms a type-1 fuzzy controller and an interval type-2 fuzzy method for the insulin infusion. The closed loop system has been simulated for different patients with different parameters, in present of the food intake disturbance and it has been shown that the blood glucose concentrations at a normoglycemic level of 110 mg/dl in the reasonable amount of time. This paper deals with type 1 diabetes as a nonlinear model, which has been simulated in MATLAB-SIMULINK environment. The novel model, termed the Augmented Minimal Model is used in the simulations. There are some uncertainties in this model due to factors such as blood glucose, daily meals or sudden stress. In addition to eliminate the effects of uncertainty, different control methods may be utilized. In this article, fuzzy controller performance were assessed in terms of its ability to track a normoglycemic set point (110 mg/dl) in response to a [0-10] g meal disturbance. Finally, the development reported in this paper is supposed to simplify the insulin delivery, so increasing the quality of life of the patient.