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Master Thesis Defense

Entitled

*CONTROLLABILITY AND OBSERVABILITY OF BLOOD GLUCOSE LEVELS AND THE IMPACT OF
COVID-19 ON DIABETIC PATIENTS*

by

Mahra Salem Nasser Abdulla AlBlooshi

Faculty Advisor

Dr. Abdessamad Tridane, Department of Mathematical Sciences

College of Science

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Abstract

Diabetes is a metabolic disorder that is characterized by high blood glucose concentrations resulting from insulin deficiency in case of type 1 or insulin inefficiency in case of type 2. While no cure of diabetes exists, the artificial pancreas is a possible way to manage diabetes, especially for type 1 diabetics. Where an artificial pancreas is a closed loop control system with an integrated mathematical model that imitates the function of a healthy pancreas. This thesis is concerned with the control system of an artificial pancreas that is based on the Bergman's minimal model of the glucose-insulin dynamics. In this thesis proofs of both the controllability and the observability of the model are presented. In addition, since COVID-19 was found to be more severe towards patients with comorbidities including diabetes, a COVID-19 disease transmission model that focuses on comorbidity populations is presented in this thesis along with some related calculations and analysis.

Keywords: Diabetes, Control systems, Controllability, Observability, COVID-19.