BEA SMART

Smart Technologies for Biomedical and Environmental Applications
A joint DEWS@UNIVAQ – IASI@CNR Laboratory

DEWS CENTER OF EXCELLENCE

IASI

III Workshop BEA-SmarT

DEWS-UNIVAQ
Martedì 28 gennaio 2020
Sala Seminari Edificio "Alan Turing"
Coppito - L'Aquila

11:00-12:00

INVITED SPEAKER

Claude Moog (CNRS/Ecole Centrale de Nantes)

The hypoglycaemia free artificial pancreas project

Driving blood glycaemia from hyperglycaemia to euglycaemia as fast as possible while avoiding hypoglycaemia is a major problem for decades for type-1 diabetes and is the concern in this talk. A control algorithm is designed that guaranties hypoglycaemia avoidance from the theory of positive systems point of view and from the most pragmatic clinical practice. The solution consists of a state feedback control law that computes the required hyperglycaemia correction bolus in real-time to safely steer glycaemia to the target. The so-called hypo-free strategy control is tested with all the UVA/Padova T1DM simulator patients (i.e. ten adults, ten adolescents, and ten children) during a fasting-night scenario and in a hybrid closed-loop scenario including three meals. The theoretical results are assessed by the simulations on a large cohort of virtual patients.

12:00-13:00

Pasquale Palumbo (University of Milano-Bicocca)
Mario Di Ferdinando (University of L'Aquila)
Alessandro Borri (CNR-IASI, Rome)

Model-based control of plasma glycemia: in quest of robustness

Type 2 Diabetes Mellitus (T2DM) involves an inadequate compensatory insulin secretory response. It accounts for 85% to 95% of all cases of diabetes, thus having a relevant impact in worldwide National Health Systems. A time-delay model is used to describe the glucose–insulin regulatory system, aiming at detailing the endogenous pancreatic insulin release, not negligible in T2DM. Uncertainties, devices malfunctioning and physical constraints usually prevent to design the control law in ideal conditions. Two approaches are presented, aiming at facing the discrete feature of glucose measurements and the uncertainty of meal assessment. Both criticalities are approached according to two rigorous control methodologies: stabilization in the sample-and-hold sense and symbolic methods. The theoretical results obtained demonstrate the validity of the approach, and are also validated through the UVA/Padova virtual environment, broadly accepted for the pre-clinical testing of glucose control strategies.