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Modelling in anaesthesia and intensive care: a special section including papers from IFAC's 8. Symposium on Medical and Biological Systems in Budapest 2012

Steen Andreassen[1], Thomas Desaive[2], Dan S. Karbing[1]

[1]*Center for Model-based Medical Decision Support (MMDS), Aalborg University, Aalborg, Denmark*

[2]*Thermodynamics of Irreversible Processes, University of Liège, Liège, Belgium*

This issue of the Journal of Clinical Monitoring and Computing includes a special section with papers from the International Federation of Automatic Control's (IFAC) 8. Symposium in Budapest 2012 on Biological and Medical Systems. These symposia provide a multi-disciplinary forum for communication between the medical and the technical disciplines including modelling and control.

This issue includes extended versions of full papers invited from selected authors following the symposium [1] and an editorial from the guest editors from IFAC's Technical Committee on Biological and Medical Systems [2].

Five full papers [3-7] were accepted following peer review for publication in this issue. All papers are based on the approach that a model of the relevant physiology can be used to predict the effects of therapeutic interventions and thus help to select optimal interventions for the individual patient. The first two papers [3, 4] present models of the cardiopulmonary system and the last three papers present models of the peripheral [5] or central nervous system [6, 7] during anaesthesia.

Thomsen et al. [4] focus on a pulmonary gas exchange model, including shunt and pulmonary ventilation/perfusion mismatch. They show that in COPD patients, identification of gas exchange parameters can be done from data recorded during 4-5 changes of inspiratory oxygen without waiting for steady-state conditions. This is particularly useful in COPD patients, because achieving steady-state conditions in these patients may take 10-15 min, as opposed to the typical 2-4 min.

Texeira et al. [5] present a "switching strategy" for controlling neuromuscular blockade during surgery. Control is switched between a bank of 50-100 patient models, selecting at any time the model, which provides the best fit between simulated and measured neuromuscular blockade. Simulations indicated that the switching strategy would outperform an Extended Kalman Filter. The switching strategy achieved adequate blockade in two patients infused with *rocuronium*.

The paper by Rocha et al. [6] develops regression equations in patient specific parameters (age, weight, height and lean body mass) for bolus and continuous infusion of the anaesthetic propofol. These equations are shown retrospectively to give a good prediction of the bolus and infusion rates provided by commercially available systems, as well as propofol concentrations at the effector site close to the target value, according to a PK/PD model.

The last paper by Ionescu et al. [7] expands the control of propofol infusion in several directions. In their approach the bispectral index is used as a measure of the depth of anaesthesia and they model the interaction between propofol and the analgetic *remifentanil*. The paper also discusses physiological parameters, including EMG, which may be useful to determine the level of analgesia.

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