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Model and Neural Control of the Depth of Anesthesia during Surgery

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Abstract : At present, the experimentation of anesthetic drugs on patients requires a regulation protocol, and the response of each patient to several doses of entry drug must be well known. Therefore, the development of pharmacological dose control systems is a promising field of research in anesthesiology. In this paper, it has been developed a non-linear compartmental the pharmacokinetic-pharmacodynamical model which describes the anesthesia depth effect in a sufficiently reliable way over a set of patients with the depth effect quantified by the Bi-Spectral Index. Afterwards, an Artificial Neural Network (ANN) predictive controller has been designed based on the depth of anesthesia model so as to keep the patient in the optimum condition while he undergoes surgical treatment. For the purpose of quantifying the efficiency of the neural predictive controller, a classical proportional-integral-derivative controller has also been developed to compare both strategies. Results show the superior performance of predictive neural controller during BiSpectral Index reference tracking.

Keywords : anesthesia, bi-spectral index, neural network control, pharmacokinetic-pharmacodynamical model
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