Control of Depth of Anesthesia using MUSMAR - Exploring Electromyography and the Analgesic dose as Accessible Disturbances

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Abstract

The problem of controlling the level of depth of anesthesia measured by the bispectral index (BIS) of the electroencephalogram of patients under general anesthesia, is considered. It is assumed that the manipulated variable is the infusion rate of the hypnotic drug propofol, while the drug remifentanil is also administered for analgesia. Since these two drugs interact, the administration rate of remifentanil is considered as an accessible disturbance in combination with the level of electromyography (EMG) that also interferes with the BIS signal. In order to tackle the high uncertainty present on the system, the predictive adaptive controller MUSMAR is used. The performance of the controller is illustrated by means of simulation with 45 patient individual adjusted models, which incorporate the effect of the drugs interaction on BIS. This controller structure proved to be robust to the EMG and remifentanil disturbances, patient variability, changing reference values and noise.