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REAL TIME EMOTIONAL CONTROL FOR ANTI-SWING AND POSITIONING CONTROL OF SIMO OVERHEAD TRAVELING CRANE

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Abstract. *Research in artificial intelligence and bioinspired algorithms is still being actively pursued in different fields of engineering. In this work, Brain Emotional Learning Based Intelligent Controller (BELBIC) is applied for real time positioning of laboratorial overhead traveling crane. This controller is based on biologically motivated algorithm originating from emotional processes in the limbic system of the mammalian brain. Simulations show that learning capability, adaptation, robustness and other control concerns of this controller are comparable with conventional techniques and lead to better performance in many cases. Two objectives, tracking desired position and keeping pendulum vertically, must be considered simultaneously. A bottom up strategy was utilized for designing the controllers. First separated BELBICs were designed for each control task. Next, in order to compensate the actual coupling between control tasks, the objective of each control tasks was considered in the stress signal of the other one. Obtained results in real tracking applications are also comparable with other conventional and intelligent approaches such as hierarchical fuzzy control (HFLC) and confirm the simulation results. Learning capability, model free control algorithm, robustness and fast response are main characteristics of this controller and designer can define emotional stress signal based on control application objectives.*

Keywords: BELBIC, Model Free Control, HFLC, PID Controller

1. **Introduction.** Brain Emotional Learning Based Intelligent Controller (BELBIC) is an example of bioinspired control methods which is based on limbic system of mammalian brain. This controller is based on emotional behaviors in biological systems. Emotion is an emergent behavior in biological systems for fast decision making in complex environments. The advantages of this behavior cannot be neglected in creature survival.

Several attempts have been made to model the emotional behavior of human brain [1], [2], and [3]. In [2] the computational models of Amygdala and context processing were introduced. Based on the cognitively motivated open loop model, BELBIC was introduced in [4] and after that this controller was utilized in several applications. Applying BELBIC in Speed control of an interior permanent magnet synchronous motor was shown in [6]. In [5] a modified version of BELBIC was applied to heating, ventilating and air conditioning (HVAC) system which is multivariable, nonlinear and non minimum phase. In [7] this controller was used for controlling identified washing machine and in [8] this controller was