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ADAPTING C2 to the 21st Century

Title: Adaptive automation that recognizes system faults in a complex C2 information system
Topic: Modeling & Simulation

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This paper introduces an adaptive human-computer interface (HCI) designed from Living Systems Theory (LST) of James Miller. From biologically inspired perspective, the LST allows for introduction of learning algorithms into human-computer interface designs to encourage auto-adaptation. The LST methodology is based on abstraction hierarchy in which energy-matter information exchanges take place between and within the information layers in the system structure. To capture system adaptive behaviors, we introduce finite state automata models into the LST constructs so as to identify the mechanisms which inspire adaptations. The constructs use fuzzy-based finite state automata (FFSA) to allow the LST to interact with the environment information derived from the task and the user. The system of interest is assumed to have three states—normal, partially normal, and failure states. The boundaries between these states are captured with Dubois's triangular norm. With the understanding that each system state can be described fuzzily (e.g., the normal state can be "most certain", "quite certain", and "likely certain") we develop FFSA rules that allow the system to recognize faults by recognizing the conditions that trigger spatio-temporal (when, where, and how)

adaptations based on unexpected events. We demonstrate the adaptive HCI with a power plant information management.