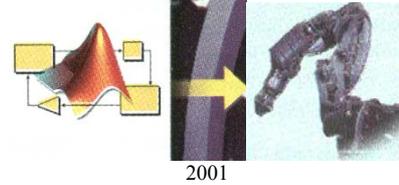




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Network Q-Learning Controls Prevent Cyber Intrusion Risks: Computational Intelligence, Communications and Control Synergy

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Abstract. *Abstract*—A Metropolis criterion based fuzzy Markov game flow controller (MFMC) has been developed and proposed to cope with congestion problems in high-speed networks under uncertainties. Because of uncertainties and highly time-varying time delays, for such networks the complete and accurate information is not easy to obtain in real time. The Q-learning, which is independent of mathematic model and prior knowledge and yet enables achieving good performance, is a viable alternative. The fuzzy Markov game offers a promising platform for robust control in the presence of external disturbances and unknown parameter variations that are bounded as well as suspected sudden variation. The Metropolis criterion can cope with the balance between exploration and exploitation in action selecting in an optimum searching way. Simulation experiments demonstrate the proposed controller can learn to take the best action in order to regulate source flows. Thus it can guarantee both high throughput and low packet loss ratio while efficiently avoiding the congestion.

Keywords. Communication flows, High-speed networks, Fuzzy Markov games, Metropolis Q-learning, Neural-net learning optimization, Reducing cyber attack risks.

Respectfully,

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