Spectral tunability and high-speed LED switching capability, combined with networks of advanced sensors and adaptive lighting communications and control architectures, are leading to the development of sensory lighting systems that can autonomously adapt illumination to the needs of those occupying a given space. These sensory capabilities will enable improved lighting-system energy efficiency as well as improved human health and productivity. Future illumination systems will also likely feature both intra-system (light-to-light) optical communications and data communications that will augment RF-based communications systems for scalable, secure wireless communications. In addition, digitally modulated (and structured) lighting offers novel approaches to occupancy sensing (of both animate and inanimate objects). By improving the sensory functionality of illumination systems, adaptive lighting control methods superior to the current lighting management methods in use today will be possible.

This talk discusses new experimental results on advanced lighting system controls based on technologies well beyond current commercially available systems. This research involves the integration of advanced SSL luminaires, sensor networks and advanced control methods designed to maximize energy efficiency while providing new features and services for human-centric lighting, building system integration and data communications. With a longer-term goal of defining the technologies and methods required to construct self-commissioning lighting systems, the current status of lighting systems that are not just smart, but can think and adapt, will be described.

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