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Maximizing the bandwidth while minimizing the spectral fluctuations using supercontinuum generation in photonic crystal chalcogenide fibers

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Supercontinuum generation in the mid-infrared (mid-IR) spectrum has a broad array of potential applications in medicine, environmental sensing, and defense. It is desirable to have a source that acts like a mid-IR “light bulb” to produce a broadband, flat, and incoherent spectrum. In work to date, we have demonstrated that it is possible to obtain a bandwidth of 4 micro metre in As_2Se_3 chalcogenide hexagonal photonic crystal fibers that are pumped at 2.5 micro metre with pulse durations that are 500 fs or longer and pump peak powers of 1 kW or more with careful design of the fiber parameter. A difficulty with this early work is that the bandwidth is highly sensitive to changes in both the pump power and the pulse duration. However, in real systems both the pulse energy and the pulse duration will fluctuate by a large amount - about 10% in experiments that have been carried out at the Naval Research Laboratory. As a consequence, we expect that the actual spectrum that is produced by supercontinuum generation is far smoother and the bandwidth more stable than single-simulation results would indicate, and more recent results bear out this expectation. In recent work, we have carried out extensive simulations to determine the spectrum that would appear in a real system and to find computationally efficient methods for calculating that spectrum. Using simulations with up to 10^6 individual simulation runs, we have shown that the spectrum can be reasonably estimated with as few as 100 simulation runs and that the spectral fluctuations with a 0.1 nm range are just a few dB. In this presentation, we will both review our older results and present our new results.

Biography

Curtis R Menyuk received BS and MS degrees from MIT in 1976 and PhD from UCLA in 1981. He has been a Professor of Electrical Engineering and then Computer Science and Electrical Engineering at the University of Maryland Baltimore County (UMBC) since 1986. His primary research area has been the theoretical and computational study of fiber optic systems. The equations and algorithms that his research group at UMBC has developed are used extensively in the telecommunications and photonics industry. He is a member of SIAM and a fellow of APS, the OSA, and the IEEE.

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