Fiber Lasers

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Fiber lasers and amplifiers are having a major impact in a remarkably wide variety of applications and have exhibited the highest market growth rate among laser technologies for several years. Starting in the 1990s with the revolution in optical telecommunications triggered by development of the erbium-doped fiber amplifier, fiber sources now enable numerous applications because of their uniquely practical combination of optical and physical characteristics. Rapid advances in attainable power and energy, wavelength coverage, and temporal, spectral, and polarization control of fiber sources have resulted from technical innovations in a number of areas, including fiber design and fabrication, fiber-processing techniques, laser architectures and pumping methods, fiber-based components, modeling, and fundamental understanding of key physical process. This special section of *Optical Engineering* comprises nine papers that cover many of these developments, providing a timely overview of fiber laser technology and an introduction to current areas of research.

The nine papers in the special section can be categorized as follows:

- **Fiber design and fabrication**: Koponen et al. describe progress in direct nanoparticle deposition for manufacturing fibers optimized for power scaling of cw and pulsed-fiber sources, including control of the dopant and refractive-index profiles. Tankala et al. report a testing methodology for double-clad fibers and a durable, low-index, polymer coating designed for high mechanical and optical stability even in humid environments. Hansen et al. describe microstructured air-clad fibers and associated components for fabrication of high-power cw and pulsed-fiber sources.
- **Fiber characterization**: Yablon details powerful new techniques for three-dimensional characterization of the fiber refractive index and spontaneous-emission profiles applicable to fibers, splices, tapers, gratings, and other structures. Laurila et al. present a modal analysis of large-mode-area fibers using a relatively new method, S^2 imaging, including the effects of fiber bending and seed-launching conditions.
- **Fundamental processes**: Montiel i Ponsoda et al. report mechanistic studies of photodarkening in Yb-doped fibers, an area that has received significant attention and seen substantial progress in the past several years, and report a new method for accurate control of the fiber temperature. Soh and Koplow present a detailed model, simulations, and experimental results for spectral broadening of incoherent cw light in optical fibers.
- **Power scaling**: Wang and Sanchez describe passive coherent combination of up to four polarization-maintaining fiber lasers using a fused-fiber combiner, resulting in an all-fiber architecture. Goodno et al. report a 600 W, single-mode, single-frequency, Tm-doped fiber laser operating in the 2-μm spectral region, which is of great interest for directed-energy and remote-sensing applications.

I would like to thank the authors, reviewers, and *Optical Engineering* editorial staff for their contributions to this special section. As illustrated in the nine papers, advances in fiber-laser technology are occurring at a rapid pace, and this progress is anticipated to continue for the foreseeable future. I hope the readers of these papers will find them to be a useful overview of recent developments and a catalyst for further advances.

Dahv Kliner obtained a PhD in physical chemistry from Stanford University, where he studied the quantum-state-resolved dynamics of gas-phase chemical reactions. He performed postdoctoral research in ultrafast spectroscopy at the University of Minnesota and in atmospheric chemistry at Harvard University. He was at Sandia National Laboratories in Livermore, California, from 1997 until 2008, where he led Sandia's fiber-laser program. This program, involving more than 20 researchers at multiple institutions, developed key enabling technologies for power scaling of cw and pulsed fiber sources and pursued a variety of chemical and physical sensing applications. He is now at JDSU in Milpitas, California, leading development of kW fiber lasers for materials processing.