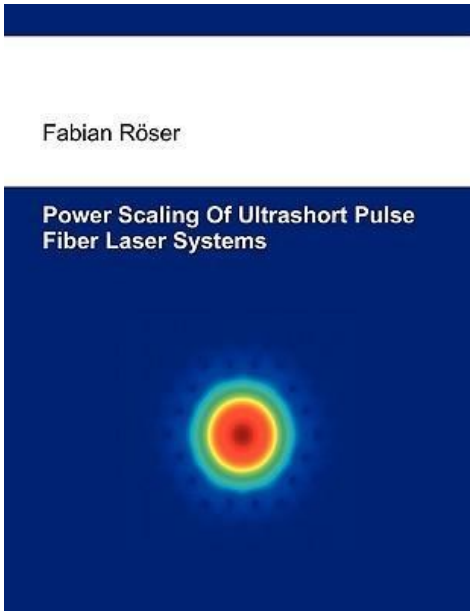

Power Scaling of Ultrashort Pulse Fiber Laser Systems

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Ultrashort pulse sources have become a versatile tool for a wide range of applications ranging from fundamental science to industrial usage. Commonly used pulse sources as the Titanium doped sapphire laser are limited in average output power due to their susceptibility to thermo-optical effects. Clearly, many applications would greatly benefit from an increase in average power in terms of a lower processing time. The use of optical fibers as gain medium overcomes such thermo-optical limitations, but ultrashort pulse amplification is restricted due to the onset of nonlinear effects. Therefore major efforts have been made to develop fibers exhibiting low nonlinearity. One of the most successful types is the so called photonic crystal fiber featuring microstructured waveguides. This work is focused on the investigation of the viability of such fibers for the scaling of average power and pulse peak power in fiber based ultrashort pulse systems. Emphasis is placed on the development of an appropriate model of the pulse amplification process that enables to formulate design guidelines for fiber based ultrashort pulse amplification. These design guidelines and the implementation of microstructured fibers of extreme dimensions led to the experimental realization of fiber laser systems pushing the limits of both average power and pulse peak power. These experiments are described and discussed in this book.