

激光技术

飞秒被动锁模环形腔掺Er3+光纤激光器

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摘要 在考虑增益、损耗、群速度色散、自相位调制、快速可饱和吸收体等各种参数同时作用情况下, 分析了非线性偏振旋转效应自启动锁模机理, 研究了腔体参数与锁模脉冲之间的关系, 并给出飞秒被动锁模环形腔掺Er3+光纤激光器实验原理。实验采用性能稳定的980nm半导体激光器作为抽运源, 高掺杂短长度掺Er3+光纤作为增益介质, 利用非线性偏振旋转锁模技术, 得到了稳定的飞秒自起振锁模光脉冲。抽运功率为23mW时, 激光器输出锁模脉冲中心波长1552nm, 3dB带宽为7.6nm, 重复频率14.0MHz, 平均输出功率0.43mW, 自起振锁模泵浦阈值功率11.5mW, 并观测到了稳定的高阶锁模脉冲输出。该激光器与报道过的相同结构光纤激光器相比, 自起振泵浦阈值低、脉冲能量高、稳定性好, 且频谱边带幅度小。

关键词 [光纤激光器](#) [光孤子](#) [被动锁模](#) [飞秒脉冲](#) [掺Er3+光纤](#)

分类号

Femtosecond passively mode locked Er3+ doped fiber ring laser

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Abstract

The self starting mode locked mechanism of nonlinear polarization rotation and the characteristics of the pulses were theoretically investigated with various parameters taken into account, such as gain, loss, group velocity dispersion, self phase modulation and fast absorber. A fiber ring laser with a small segment of highly Er3+ doped fiber as gain medium, which is pumped by 980nm LD laser and mode locked by using the nonlinear polarization rotation technique, is successfully demonstrated for the generation of femtosecond pulses. When the laser was pumped at 23mW, stable mode locked pulses centered at 1552nm with 7.6nm bandwidth and an average output power of 0.43mW was successfully obtained at the repetition rate of 14.6MHz. The threshold power of the self starting mode locked pumping is about 11.5mW. The high order stable mode locked pulses were also observed experimentally. Compared to the fiber lasers with the similar structures reported previously, the laser presented here has the advantages of very low self starting pumping threshold, high pulse energy, small spectral sideband and better stability.

Key words [fiber laser](#) [optical soliton](#) [passively mode locked](#) [femtosecond pulse](#) [Er3+ doped fiber](#)

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