01a

Advisor: Dr. Efraín Mejía Beltrán

Committee Members: Dr. Yury Barmenkov (Secretary)

Dr. Olivier Pottiez (Evaluator)

Dr. Efraín Mejía Beltrán (Chairperson)

Thesis: "HYBRID (RAMAN-YTTERBIUM) RING-CAVITY FABRY-PEROT-FILTERED FIBER LASER"

Summary:

In this thesis, two different main projects were implemented. In the first project, we studied the experimental behavior of nonlinear Raman scattering in a single-mode Nufern 980-HP silica fiber of 1-km in length pumped a 1064-nm. We reconsider some approximations and physical facts that construct the model of Raman amplification. The motivation for this study is based on the fact that the theoretical model neglects the contribution of the small spontaneous Raman scattering (RS) signal; this is what becomes coupled and accumulated along the Raman gain medium (optical fiber), fundamental in the amplification process and; on the other hand, the Raman gain efficiency (gR) is assumed as a constant parameter for any coupled pump intensity; therefore, the theoretical model does not correspond exactly to the experimental behavior. To consider the small RS signal, we defined a Raman generator coefficient that, added to the differential equations that govern the phenomenon, allowed us to approximate the theoretical model to the experimental behavior, particularly at the threshold where typical models predict a soft Stokes generation; on the contrary, experiments present an abrupt generation. Parallel, we show that the gR is not a constant parameter.

In the second project, we present the study and the results of the modification of a Raman fiber laser. The study started with the simplest wide spectral emitting free-running distributed feedback configuration, then it was modified to a ring cavity; later, a Fabry-Perot filter was inserted within the feedback loop. Finally, 3-meters of ytterbium-doped fiber was spliced as a Stokes amplifier. In the end, the results show an important performance improvement as the laser configurations evolve; for example, laser emission is stable, less than 1-nm single Stokes line is emitted, the conversion efficiency increased, and the threshold decreased, they compared to the previous configurations. We propose this approach to be used when high stability, high efficiency, and single-line emission is desired in RFLs.

Atentamente,