A SIMPLE MATHEMATICAL MODEL FOR REGENERATIVE CO_2 LASER PULSE AMPLIFICATION

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A simplified theoretical analysis based on a modified rate equation model[1] used to describle a TEA CO_2 laser oscillator is employed to study some of the basic parameters of CO_2 laser regenerative amplifiers. It is based on the assumption that the net round trip gain $2\alpha L_g > I$ where α is the gain coefficient and L_g is the Length of the gain medium.

The rate equations were assumed to remain unchanged from those of a gain - switched laser except that after the time of injection the initial intra - cavity radiation was considered to be a superposition of the injected signal and that due to spontaneous emission.

The model has yielded useful information on the injection time window and shows that for an injected pulse to dominate laser emission of a slave oscillator, injection should occur within the allowed time window and at all times must be sufficiently more intense than the intra-cavity noise signal. It is however necessary to limit the injected power if degradation of the gain switching action is to be avoided; all theoretical data agreeing reasonably well with experimental results reported[2].

References

Dyer P.E. and James D.A. (1975) J.Phy.E.
Dyer P.E. and Perera I.K. (1980) Appl. Phys. 23:245

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