

CLAIMS

1. Optical apparatus (20, 50), comprising:
 - a laser (31, 54), which is configured to output a first optical pulse train at a controllable pulse repetition rate (PRR);
 - an optical coupler (30), which is configured to combine the first optical pulse train with a second optical pulse train received from a reference source (28, 52) at a reference PRR;
 - an optical detector (32) coupled to output an electrical beat signal in response to constructive interference between the combined first and second optical pulse trains; and
 - control circuitry (38) configured to adjust the PRR of the laser responsively to the electrical beat signal.
2. The apparatus according to claim 1, wherein the laser is mode-locked.
3. The apparatus according to claim 1 or 2, and comprising an intradyne coherent receiver, which comprises the optical coupler and the optical detector.
4. The apparatus according to claim 3, wherein the intradyne coherent receiver is coupled to receive a pulsed optical information signal over an optical communication link and to extract data from the pulsed optical information signal by mixing the pulsed optical information signal with the first optical pulse train.
5. The apparatus according to claim 4, wherein the laser generating the first optical pulse train is a local laser,

and the reference source comprises a remote laser, which generates the pulsed optical information signal, and

wherein the control circuitry is configured to synchronize the PRR of the local laser with the remote laser.

6. The apparatus according to claim 5, wherein the control circuitry is configured to synchronize the PRR of the local laser with the remote laser under conditions of negative optical signal/noise ratio on the optical communication link.

7. The apparatus according to claim 3, wherein the laser generating the first optical pulse train is a first laser, and the reference source comprises a second laser, and

wherein the control circuitry is configured to synchronize the PRR of the second laser with the first laser.

8. The apparatus according to any of claims 1-7, wherein the optical mixer comprises an optical hybrid, which is configured to generate in-phase (I) and quadrature (Q) outputs, and

wherein the optical detector is configured to sense both the I and Q outputs.

9. The apparatus according to any of claims 1-8, wherein the optical mixer comprises at least a first mixer coupled to receive a first polarization of the first and second optical pulse trains and a second mixer coupled to receive a second polarization of the first and second optical pulse trains, and

wherein the optical detector is configured to output the electrical beat signal in response to the constructive interference in both the first and second polarizations.

10. The apparatus according to claim 9, wherein the control circuitry is configured to adjust a polarization of the laser responsively to the electrical beat signal.

11. The apparatus according to any of claims 1-10, wherein the control circuitry is configured to drive the PRR of the laser, based on the electrical beat signal, to maximize an overlap between the first and second optical pulse trains.

12. The apparatus according to claim 11, wherein the control circuitry comprises a peak detector, which is configured to detect the overlap between the first and second optical pulse trains.

13. The apparatus according to any of claims 1-12, wherein the control circuitry is configured to measure a pulse shape of the first optical pulse train by sensing an amplitude variation of the electrical beat signal while a phase of the first optical pulse train shifts relative to the second optical pulse train, thereby measuring a cross-correlation between the first and second pulse trains.

14. The apparatus according to any of claims 1-13, wherein the control circuitry is configured to measure a carrier-envelope offset (CEO) frequency difference between the first and second optical pulse trains.

15. A method for controlling a laser (31, 54), which outputs a first optical pulse train at a controllable pulse repetition rate (PRR), the method comprising:

optically mixing the first optical pulse train with a second optical pulse train received from a reference source (28, 52) at a reference PRR, thereby generating an optical beat signal in response to constructive interference between the first and second optical pulse trains; and

adjusting the PRR of the laser responsively to the optical beat signal.