Long-Range, High Resolution Laser Radar Range Detection

A Series Of Simplified Graphs Illustrating The Generation Of A Spectral Peak By Interfering A Reference Optical Pulse And A Reflected Optical Pulse

Systems and methods for long-range, high resolution laser radar range detection

Laser radar is simply radar transformed from measuring reflected radio frequency electromagnetic radiation to locating spatially removed objects via laser radiation. A combination of radar and optics provides a system with inherently enhanced accuracy in the measurement of range, velocity and angular displacement, creating an overall improved countermeasure resistance. Disadvantageously, the penetrating ability of optical radiation is severely degraded by, for instance, weather related atmospheric disturbances. Consequently, the major developments in laser radar technology have been directed at range-finding capabilities, particularly as fire control for mobile and air defense weapons systems. Laser radar systems typically use the time of travel of a reflected signal to calculate that object’s range value. The accuracy of the time travel calculation, however, is limited to the length of the laser pulse utilized by the system. For this reason, short pulse lasers are ideally used to increase accuracy and resolution. Additionally, measurement over long distances requires laser pulses to have high total energy levels for reliable reflected laser detection. The short pulses, however, are difficult to amplify to an energy level sufficient to achieve desirable long range performance. Longer pulses that are capable of containing sufficient energy, however, reduce the resolution to an undesirable level. Thus, a need exists in the industry to provide high-resolution long-range laser radar range detection.

Technical Details

The present invention is a laser based radar system for imaging and target identification that uses long frequency modulated optical pulses. It maintains high resolution and accuracy, despite the long optical pulses used for target identification. The key feature is that long stretched optical pulses can be easily amplified to high pulse energies, which are necessary for long range radar, but with this invention, is still possible to obtain millimeter length distance resolution even though the optical pulses would normally imply range resolution of approximately 5 feet. By using optical mixing/ heterodyning and interferometry this technology is able to realize excellent length resolution.

Benefits

• Improved range of visibility, resulting in high resolution imaging down to millimeters in length
• More compact in physical dimensions, which is attractive to volume-limited applications
• Has all the resolution advantages of a short pulse laser radar with the long range performance of a long pulse radar

Applications

• Military imaging and target identification
• Radar systems to significantly increase accuracy and resolution of current technologies

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