AVAILABLE TECHNOLOGY

Florida Institute of Technology

OPTICAL IMAGING USING ULTRAFAST LASER FOR TUMOR DETECTION

Summary

The technology is a new approach of utilizing ultrafast laser for optical imaging.The conventional time-resolved optical imaging technologies rely on the computationally intensive inverse analysis for image reconstruction. This technology avoids that by selecting an optimum temporal pulse width based on the probed medium's intrinsic radioactive properties. Once the pulse width is determined, the time-resolved reflectance signals can reveal the location and size of inclusion within the probed medium without resorting to the inverse analysis algorithm.

Applications

- This is intended for optical imaging in small thickness, layered tissues.
- It can be applied to underwater object detection as well.

Advantages

- Does not require computational intensive inverse analysis to obtain images

The Technology

Optical imaging using lasers has been in development for the last two decades due to its advantages over the other imaging modalities: non-ionizing radiation source, providing physiological information of the probed tissues, etc. However, except the optical coherence tomographies, the existing methods, for example, the commonly used diffusion optical tomography, are unable to provide high-resolution information (size, location) about the tis- sue inclusions.

The problem is due to the difficulty in distinguishing the information-bearing ballistic and snake photons from the image-smearing multiple-scattered photons. A special parameter, called the pulse number, was developed to aid the selection of pulse width so the scattered photons' effect can be separated in the temporal signal.

It is found that at large pulse width or pulse number, the signal due to the ballistic/snake photons are masked by the multiple-scattered photons. The patent will determine, based on the probed medium or tissue and inclusion's radioactive properties, an optimal temporal pulse width of the probing ultrafast laser. The temporal reflectance signal received at the fiber-optic transducer can reveal a unique spatial profile of the inclusion. Several source/detector units can be placed around the object to be imagined. The collected signals are processed to construct three-dimensional images of the target. No inverse analysis of the light pulse scattering process is required to construct the images. Currently the skin tissue is the most suitable object for this imaging technology. Imaging on other tissues, for example, breast, colon and gums, also holds potential.

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