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学 位 （ 博 士 ） 論 文 要 旨
(Doctoral thesis abstract)

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論文題目 Title	波連特性を利用した光学的雑音低減方法の研究 (Optical noise reduction based on wave train characteristics)				

論文要旨 (和文要旨(2000 字程度)または英文要旨(500words))
※欧文・和文どちらでもよい。但し、和文の場合は英訳を付すこと。
Write a summary in Japanese (2000 characters) or in English (500words).
If the abstract is written in Japanese, needed to translate into English.

Both the scattering and absorption cross-sections of NIR light are smaller than those of visible light, so that NIR light can more deeply penetrate an organism than visible light. Moreover, the water content of an organism absorbs less NIR light and thus allows NIR light to more deeply penetrate the organism compared with infrared light. Therefore, NIR light is suitable for measuring the status or change of status inside an organism. However, NIR light tends to generate greater spectral noise than visible light. To date, spectral noise arising from optical interference has obstructed accurate measurements of the overtones and combinations of group vibrations because the detection signal relating to the overtones and combinations is too small in the NIR spectrum. It is therefore important to reduce spectral noise. Therefore, highly accurate spectrometry requires spectral noise reduction.

In my investigation, we propose a phase unsynchronized wave synthesizing (PuwS) method that provides different optical path lengths for respective wave elements obtained from wavefront division and synthesizes the respective wave elements to have the same propagation direction. PuwS method achieves spectral noise reduction and contributes to temporal coherence control.

To confirm the properties observed in experimental data, I propose a series of analytic models based on a traditional wave train model. Though many analytic investigations regarding speckle noise have been reported, I have found no analytic investigation that explains a particular mechanism providing the spectral noise. Therefore, I had to newly propose an original analytic model that can explain how to provide the spectral noise. In order to confirm reliability of each of the analytic models, each of the analytic models requires each of experimental data support.

The paper start setting a fundamental analytic model regarding optical interference based on a traditional wave train model. And first corresponding experimental data verify that the fundamental analytic model is reliable.

After establishing reliability of the fundamental analytic model, the fundamental anarchically model grows up to be a most important spectral noise generation model that can explain how to provide the spectral noise. According the spectral noise generation model, an unideal optical path in an experimental optical system extracts minor light beams (noise generating beams) from a major light beam, and a combination between the minor light beams and the major light beam provides the spectral noise based on optical interference when a optical phase of the major light beam differs from at least one of optical phases of the minor light beams. Second corresponding experimental data prove reliability of the spectral noise generation model.

At the final stage, the spectral noise generation model grows up to be an intensity summation model regarding the respective wave elements because PuwS method requires intensity summation of all of the respective wave elements. And the intensity summation model finally describes the spectral noise reduction mechanism that averages all of different spectral noises provided by the respective wave elements. Herein, third corresponding experimental data indicates reliability of the intensity summation model.

(英訳) ※和文要旨の場合(300 words)

If the abstract is written in Japanese, needed to translate into English.(300 words)