

## 養成技術者の研究・研修成果等

1. 養成技術者氏名 : 高峰 (GAO Feng)
2. 養成カリキュラム名 : 3次元光 CT 用画像再構成アルゴリズム研究開発
3. 養成カリキュラムの達成状況

I have finished all the tasks.

4. 成果 (A4版3枚程度)

- An image reconstruction algorithm using full time-resolved data and time-slices has been developed and compared with those algorithms that use the featured data-types. The study demonstrated the potential advantage of time-resolved methodology of diffuse optical tomography over continuous-wave and frequency modulation modes.
- An image reconstruction algorithm using the modified generalized pulse spectrum technique (GPST) has been proposed that can greatly enhance image quality and reduce computation cost. This algorithm was then extended to develop a semi-3D algorithm that aims at seeking for a reasonable balance between image fidelity and computation expense. Both the numerical and experimental tests have shown that it can reconstruct image of nearly the same quality as a full 3D reconstruction with the same order of the cost as for a 2D reconstruction. This study makes a substantial advance towards developing a dynamic monitoring system of tissue oxygenation and absolute imaging scheme;
- The above proposed algorithms have been successfully applied in a few realistic cases by use of our multi-channel time-resolved tomography system for imaging the anatomical structures (absolute imaging) and localizing the hemodynamic responses during physical exercises in *in vitro* or *in vivo* organs, including chicken leg, human finger, forearm and leg. Some promising and novel results have been obtained and justified by co-registration with the relevant MRI and x-ray CT images. All the published experiments have demonstrated that a simultaneous reconstruction of absorption and scattering coefficients from time-resolved measurement has a potential to correctly reveal the changes in the optical properties associated with not only the

physiological information but also the anatomical structure of organ;

- The reflectance-type image reconstruction algorithms based on the modified GPST and mean time of flight have been developed roughly for slab geometry which can readily incorporate *a priori* knowledge of brain structures and transformed into a curved geometry for more accurate modeling. These algorithms are being used in optical topographic imaging of human brain with an aim of improving the spatial resolution and quantitative accuracy of focal changes in cerebral hemodynamics.
- A generalized 3-D image reconstruction algorithm that can work with an arbitrary mesh and optode configuration has been developed based on the featured and GPST datatypes with initial success. The algorithm takes a substantial step toward developing patient-specific DOT technology.

5. 成果の対外的発表等

(1) 論文発表 (論文掲載済、または査読済を対象。)

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(3) 特許等 (出願番号を記載)