

**Mathematical Foundation of Computer Science Laboratory**



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Professor



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## Refereed proceedings of an academic conference

[nasai-102-001-01:2017] N. Asai R. Dong, D. Cai. Nonlinear Dance Motion Analysis and Motion Editing using Hilbert-Huang Transform. In *COMPUTER GRAPHICS INTERNATIONAL 2017, Yokohama, JAPAN, 2017*.

Human kinematic motions (especially, dance motions) are very noisy and it is difficult to analyze the motions. To resolve this problem, we propose a new method to decompose and edit the motions using the Hilbert-Huang transform (HHT). First, HHT decomposes a chromatic signal into “monochromatic” signals that the so-called Intrinsic Mode Functions (IMFs) using Empirical Mode Decomposition (EMD) proposed by Huang et al (2014). After applying the Hilbert Transform to each IMF, the instantaneous frequencies of the “monochromatic” signals can be obtained. The HHT has advantage to analyze non-stationary and nonlinear signals like human joint motions over FFT or Wavelet transform. In the present paper, we propose a new framework to analyze and extract some new features from a famous Japanese threesome pop singer group “Perfume” dance, waltz, salsa, hip hop dance etc. and compare them. Using the EMD, we decompose their dance motions into different IMFs, and can scale, combine, subtract, exchange, and modify different IMFs, and can blend them into new dance motions self-consistently.

[nasai-102-001-02:2017] N. Asai R. Dong, D. Cai. Dance Motion Analysis and Editing using Hilbert-Huang Transform. In *SIGGRAPH 2017 Studio Talks Proceedings, Los Angeles, Aug. 2017*.

Human motions (especially, dance motions) are very noisy and it is difficult to analyze the motions. To resolve this problem, we propose a new method to decompose and edit the motions using the Hilbert-Huang transform (HHT). The HHT decomposes a chromatic signal into “monochromatic” signals that are the so-called Intrinsic Mode Functions (IMFs) using an Empirical Mode Decomposition (EMD)[Huang 2014]. The HHT has the advantage to analyze non-stationary and nonlinear signals like human joint motions over the FFT or Wavelet transform. In the present paper, we propose a new framework to analyze a famous Japanese threesome pop singer group “Perfume”. Then using the NAMEMD, we decompose dance motions into motion (choreographic) primitives or IMFs, which can be scaled, combined, subtracted, exchanged, and modified self-consistently.

## Writing a textbook or technical book

[lothar-102-001-01:2017] Lothar M Schmitt. *Lilies and their applications (research ongoing)*. Lecture Notes in Mathematics. undetermined, envisioned: Springer Verlag, New York - Heidelberg - Berlin, 2018.

A new method to solve differential equations is developed. Goal is to solve the Navier-Stokes equations, or at least the Euler equations. These are very old problems. Preparatory research started 2008. Mathematical research with written proofs started 2015 and is ongoing -2019. Achieved 280 pages including typewritten notes.

### **Research grants from scientific research funds and public organizations**

[nasai-102-001-03:2017] J. R. Ginsburg N. Asai, D. Cai. Hyper English Dictionary with Etymology, 2017.

### **Academic society activities**

[nasai-102-001-04:2017] Chief Examiner, The Editorial Committee of the Journal of Information Processing

[nasai-102-001-05:2017] Chief Examiner, The Editorial Committee of the IPSJ Journal

[nasai-102-001-06:2017] H. Matsushima N. Asai H. Watanabe E. Shibayama, M. Shimaoka, March 2018.

Penelist on the 80th National Convention of IPSJ

[nasai-102-001-07:2017] 2017.

member of editorial committee on SE special issue

[nasai-102-001-08:2017] 2017.

member of editorial committee on special issue for young researchers

### **Advisor for undergraduate research and graduate research**

[lothar-102-001-02:2017] finish 2019 A: Mr Kobayashi, finish 2020 B: Mr Ito. ongoing undergraduate research and supervision, Undergraduate School, The University of Aizu, 3 2018.

## Summary of Achievement

A: Mr Kobayashi is a third year student. One year supervision, help and guidance, 50-100 meetings. B: Mr Ito is a fifth year student. Four years supervision, help and guidance.

## Contributions related to syllabus preparation

[lothar-102-001-03:2017] Maintained Syllabi for Courses Mathematical Logic and Applied Geometry and Topology

## Preparation of course examination to measure comprehension

[lothar-102-001-04:2017] A: running a self-developed teaching system which measures comprehension of students in class, and manages exercises allowing students multiple submissions and learning from mistakes. B: preparation of examinations in courses Matematical Logic and Applied Geometry and Topology.

## Contribution related to toward equipment management, classroom management, building management, and crime or fire prevention.

[lothar-102-001-05:2017] Responsible for fire prevention in my lab. Regular checks whether outlets are overloaded with electrical devices, eg electrical heaters of students.

## Employment guidance

[lothar-102-001-06:2017] Continuous employment-guidance for one current student in encouraging the good student to seek an academice carreer. Outline of carreer chances in Aizu, Japan and foreign countries. In particular, the tuition-free system in Germany with its high-level CS-universities. Giving one Japanese/French student advice in regard to studying in Aizu. Overview of research groups, facilities etc.

## Advisor of a student club or circle

[nasai-102-001-09:2017] Karate circle

[nasai-102-001-10:2017] volleyball circle

**Contribution related to student management (for example, solution of a student-related problem)**

[lothar-102-001-07:2017] Made it easy in (stressful) negotiations with sad for one student to return to the lab after a long absence: without formalities and apology-meetings in sad, Soft approach without humiliation for the student. Student comes now to the lab unafraid and regularly.

**Contribution related to the building or operation of the university computer system**

[lothar-102-001-08:2017] Running a self-developed interactive teaching system in my classes which enforces attendance, distributes and grades homework automatically, allows for multiple submissions of homework. The latter is beyond human capacity. the system uses and is implemented for the rich UNIX-based computer network of The University of Aizu.

**Contribution related to planning administration for research, research conferences, or international research**

[nasai-102-001-11:2017] Organized 1st Organized BCI-Drone race

**Contribution related to educational research technology and facility planning management**

[nasai-102-001-12:2017] Faculty Development Conimitee

[nasai-102-001-13:2017] Web working Group

**Did you participate in students recruitment, support the alumni, and/or contact with student's parent? (Yes or No) If yes, please describe what you did.**

## Summary of Achievement

[lothar-102-001-09:2017] Yes. Advised parent of a prospective Japanese/French student about The University of Aizu.

## **Did you participate in Faculty Development? (Yes or No) If yes, please describe what you did.**

[nasai-102-001-14:2017] 11th essay for FD network Tsubasa on open class

## **Did you participate in Public Lectures, and/or Open Campus? (Yes or No) If yes, please describe what you did.**

[nasai-102-001-15:2017] Invited as a guest speaker of the society of Instruments and Control Engineers, Fukui UNiversity, Dec. 5, 2017 Title: Eigenvalue problem for Infinite Complex symmetric Tridiagonal Matrices and Application of Synaesthesia to Multimedial Design