Papers Published in Technical Journals and Conferences

EFFICIENT QUANTUM CIRCUITS FOR APPROXIMATING THE JONES POLYNOMIAL

Y. Nakajima, Y. Kawano, and H. Sekigawa

Quantum Information and Computation, Rinton Press, Vol. 8, No. 5, pp. 489–500, 2007.

Freedman, Kitaev, and Wang proved the equivalence between quantum field theory and quantum computation, and consequently showed that the problem of approximating the Jones polynomial (a knot invariant) at the fifth root of unity is BQP-complete. Recently, Aharonov, Jones, and Landau proposed a concrete quantum algorithm, called the AJL algorithm, that approximates the Jones polynomial at the kth root of unity in polynomial time. In this paper, we propose a new method for implementing the AJL algorithm, which improves the performance from $O\,(mn \log^2 k)$ to $O\,(mn)$, where, n is the number of strands and m is the number of crossings in a braid. Since, in the AJL algorithm, m and k are assumed to be given as polynomials in n, the difference in the performance between the original implementation and our design is significant if k is a large-degree polynomial.

Model-Based Investigation of Control and Dynamics in Human Articulatory Motion

K. Kim and H. Gomi

J. Jpn. Soc. Mech. Eng., JSME, Vol. 1, No. 3, pp. 558–569, 2007.

In this paper, modeling of human speech articulator dynamics and its motor control are presented. The model dynamics of human articulators consists of lip soft tissue around a mouth, combined with surrounding muscles and jaw bone structures. The lip soft tissue is modeled as a discrete model approximation composed of networked lumped nodal masses interconnected with adjacent ones via visoelastic elements. The stiffness of each element is adjusted to ensure the compatibility in static deformation between the discrete model and its soft tissue prototype considering each compartment size. Muscle motor commands to drive the articulator model are estimated using a control strategy of mimicking human speech motion. An inverse dynamics algorithm based on Gradient Descent Search (GDS) selectively adjusts the muscle motor command in order to produce the reference speech motion. Simple articulatory motions of the model are demonstrated by the activation of muscle motor commands, estimated from the measured human articulatory motions.

DFA Mechanism on the AES Key Schedule

J. Takahashi, T. Fukunaga, and K. Yamakoshi

FDTC 2007, pp. 62–72, Vienna, 2007.

This paper describes a DFA (Differential Fault Analysis) mechanism on the AES key scheduling process and shows how an entire 128-bit AES key can be retrieved. We make a detailed analysis of the DFA mechanism on the AES key schedule and propose general attack rules. As a result of reconsidering the best attack approach on the basis of analysis, we present a more efficient attack than the previous one. We show that we can retrieve an entire 128-bit AES key using 2 pairs of correct and faulty ciphertexts with a 48-bit brute-force search, 4 pairs of them with a 16-bit brute-force search, and 7 pairs of them without a brute-force search. These steps are enough to calculate the key with feasible computation resources.

Degradation Analysis of 2-µm DFB Laser Using Optical Beam-Induced Current Technique

T. Takeshita, T. Sato, M. Mitsuhara, Y. Kondo, M. Sugo, and K. Kato

IEEE Trans. Electron Devices, Vol. 54, No. 10, pp. 2644–2649, 2007.

The degradation behavior of 2-µm-wavelength distributed feed-back lasers with a p- and n-type InP buried heterostructure during constant-power aging is investigated. The degradation mechanism is governed by diffused defects with a parallel direction in the crystal plane. Furthermore, it is clarified that the epitaxial layers on the mesa affect both first- and second-stage degradations.

Perceptual development of phonemic categories for Japanese single/geminate obstruents

R. Mugitani, T. Kobayashi, and K. Ishizuka.

BUCLD, Boston University, Vol. 32, p.15, 2007.

In Japanese, obstruents are phonemically contrasted by their closure lengths (e.g., /seki/ for *cough* or /se:ki/ for *stoneware*). This study investigated the perceptual development of phonemic categories for obstruents on the basis of closure length (CL) in Japanese speakers. The first two experiments, consisting of discrimination and identification tasks (Exps. 1 and 2), defined actual categories for the single/geminate obstruents in Japanese adults. In accordance with the adult-defined categories, Exp. 3 tested Japanese 5- and 12-month-old infants regarding their within- and between-category discrimination of single/geminate obstruents. The results showed that, analogous with adult native speakers, 12-month-old infants perceive obstruents along the native phonemic category. Experiment 4, which used a harmonic complex tone, revealed that 12-month-olds distinguished between-category stimuli based on phonemic information, rather than solely from the simple temporal difference between their CLs. Taken together, our findings indicate that obstruents are perceived, and presumably categorized phonemically, by 12-month-old Japanese infants.

Bear's Beer

T. Amemiya, T. Maeda, and H. Ando

Interactive Design Art and Technology (iDAT), Ars Electronica, Creative Korea, Interactive Tokyo, Singapore, 2007.

When a small object in a hand-held device moves periodically and prismatically with asymmetric acceleration (strong in one direction and weak in the other), one typically experiences the kinesthetic illusion of continuous pushing or pulling by the held device. This effect was investigated because of its potential application to a hand-held, non-grounded, haptic device that can convey a sense of a continuous translational force in one direction, which is a yet missing tile in haptic research. Our demonstrations show the nonverbal interaction made possible by the hand-held device with our force perception technologies. You can take a glass of beer to the seat of the customer (a bear) that wants to drink. The tray will show you where to go.

Image Information Processing by the Human Visual System

S. Nishida

The Journal of the Institute of Image Information and Television Engineers, Vol. 62, No. 1, pp. 1–6, 2008.

Review paper based on my lecture at this annual meeting of the Institute of Image Information and Television Engineers in August 2008. The three main topics are material perception, time perception, and motion perception.