AMS Sectional Meeting Full Program

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2003 Spring Western Section Meeting
San Francisco, CA, May 3-4, 2003
Meeting #987

Associate secretaries:
Michel L Lapidus, AMS lapidus@mathserv.ucr.edu

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Saturday May 3, 2003

- Saturday May 3, 2003, 7:30 a.m.-4:00 p.m.
  Meeting Registration
  Main Lobby (3rd Floor), Thornton Hall
- Saturday May 3, 2003, 7:30 a.m.-4:00 p.m.
  Exhibit and Book Sale
  Room 331, Thornton Hall
- Saturday May 3, 2003, 8:00 a.m.-10:40 a.m.
  Special Session on Efficient Arrangements of Convex Bodies, I
  Room 211, Thornton Hall
  Organizers:
  Dan P. Ismailescu, Hofstra University ismailes@CIMS.nyu.edu
  Wlodzimierz Kuperberg, Auburn University kuperwl@auburn.edu

E Babson, University of Washington
I Novik, University of Washington
(987-13-147)

- Saturday May 3, 2003, 8:30 a.m.-10:50 a.m.
  Special Session on Beyond Classical Boundaries of Computability, I
  Room 329, Thornton Hall
  Organizers:
  Mark Burgin, University of California Los Angeles
  mburgin@math.ucla.edu
  Peter Wegner, Brown University pw@cs.brown.edu

  - 8:30 a.m.
    Supertask computation with infinite time Turing machines.
    Joel David Hamkins*, Georgia State University
    (987-03-09)
  - 9:00 a.m.
    Computation in Pitowsky and Malament-Hogarth Spacetimes.
    Oron Shagrir*, The Hebrew University of Jerusalem
    (987-68-20)
  - 9:30 a.m.
    Quantum Mechanical Principles and Computation.
    Tien D Kieu*, Swinburne University of Technology
    (987-81-10)
  - 10:00 a.m.
    Hypercomputation by Definition.
    Benjamin Wells*, University of San Francisco
    (987-03-14)
  - 10:30 a.m.
    Determinacy, Arithmetical quasi-inductive definitions, and Infinite Time Turing Machine Computations.
    Philip David Welch*, University of Bristol
    (987-03-141)

- Saturday May 3, 2003, 9:00 a.m.-10:50 a.m.
  Special Session on The History of Nineteenth and Twentieth Century Mathematics, I
  Room 425, Thornton Hall
  Organizers:
  Shawnee McMurran, California State University, San Bernardino
  mcmurran@math.csusb.edu
  James A. Tattersall, Providence College tat@providence.edu

  - 9:00 a.m.
    The evolutionary origins of mathematics ability.

- 4:00 p.m.
  Combinatorial Structure of Injective Resolutions over Semigroup Rings.
  David F Helm*, UC Berkeley
  (987-13-165)
- 4:30 p.m.
  Multiplier ideals on toric varieties.
  Howard M Thompson*, University of Michigan
  (987-14-81)
- 5:00 p.m.
  The K-theory of the flag variety and the Fomin-Kirillov quadratic algebra.
  Cristian P. Lenart*, State University of New York at Albany
  (987-05-172)
- 5:30 p.m.
  On a Pieri-Chevalley type formula for $K(G/B)$.
  Peter Littelmann*, Wuppertal/MSRI
  (987-14-184)

- Saturday May 3, 2003, 3:00 p.m.-5:45 p.m.
  Special Session on Topological Quantum Computation, II
  Room 428, Thornton Hall
  Organizers:
  Alexei Kitaev, California Institute of Technology kitaev@cs.caltech.edu
  Samuel J. Lomonaco, University of Maryland, Baltimore County lomonaco@umbc.edu

  - 3:00 p.m.
    Quantum Entanglement and Topological Entanglement.
    Louis H Kauffman*, University of Illinois at Chicago
    Samuel J. Lomonaco, University of Maryland Baltimore County
    (987-81-174)
  - 4:00 p.m.
    Quantum computations using anyons from finite groups.
    Carlos Mochon*, Caltech
    (987-68-109)
  - 5:00 p.m.
    Quantum Invariants of 3-Manifolds and Quantum Computation.
    Sergey Bravyi*, Institute for Quantum Information, Caltech
    Alexei Kitaev, Institute for Quantum Information, Caltech
    (987-00-167)

- Saturday May 3, 2003, 3:00 p.m.-6:00 p.m.
  Special Session on Beyond Classical Boundaries of Computability, II
  Room 329, Thornton Hall
  Organizers:

Mark Burgin, University of California Los Angeles
mburgin@math.ucla.edu
Peter Wegner, Brown University pw@cs.brown.edu

- 3:00 p.m.
  Turing's Life and Ideas.
  Peter Wegner*, Brown University
  (987-68-11)
- 3:30 p.m.
  SuperTuring Models of Computation.
  Dina Goldin*, University of Connecticut
  (987-68-12)
- 4:00 p.m.
  Natural Computation and Non-Turing Models of Computation.
  Bruce J. MacLennan*, Department of Computer Science, The University of Tennessee, Knoxville
  (987-68-18)
- 4:30 p.m.
  New Kind of Computer Science.
  Eugene Eberbach*, University of Massachusetts
  (987-68-13)
- 5:00 p.m.
  Continuous-space model of computation.
  Damien Woods*, National University of Ireland, Maynooth
  Thomas J Naughton, National University of Ireland, Maynooth
  J Paul Gibson, National University of Ireland, Maynooth
  (987-68-30)
- 5:30 p.m.
  Round Table

- Saturday May 3, 2003, 3:00 p.m.-5:50 p.m.
  Special Session on Qualitative Properties and Applications of Functional Equations, II
  Room 326, Thornton Hall
  Organizers:
  Theodore A. Burton, Southern Illinois University at Carbondale
  taburton@olypen.com

  - 3:00 p.m.
    Second Order Functional Equations of Neutral Type.
    Constantin C. Corduneanu*, University of Texas,Arlington
    (987-34-145)
  - 3:30 p.m.
    Existence results for second order functional differential equations

Chennai(India)
Anbarasu Sivalingam, Anna University, Chennai (India)
(987-68-123)

- 3:45 p.m.
  Maximizing Confidence That a Vector Valued Diffusion Process Will Hit a Target.
  Rod A Freed*, California State University
  (987-60-137)
- 4:30 p.m.
  Exceptional surgery and boundary slopes.
  Masaharu Ishikawa, Tokyo Metropolitan University
  Thomas W Mattman*, Cal. State Univ., Chico
  Koya Shimokawa, Saitama University
  (987-57-91)
- 4:45 p.m.
  Intrinsically Linked Graphs and Kuratowski Minors.
  Thomas R Fleming*, UC San Diego
  (987-57-89)
- 5:00 p.m.
  Some applications of the Frobenius-Perron theorem to dynamical systems in geometry.
  Jiu Ding*, University of Southern Mississippi
  (987-15-97)
- 5:15 p.m.
  Best Possible Hadamard Inqualities for Midpoint estimates.
  A. M. Fink*, Iowa state University
  Zsolt Pales, University of Debrecen
  (987-26-24)
- 5:30 p.m.
  Generalized Shifts On Cartesian Products Of Sequence Spaces lp.
  Sundaresan Kondagunta*, Cleveland State University
  (987-46-119)

Sunday May 4, 2003

- Sunday May 4, 2003, 8:00 a.m.-12:00 p.m.
  Meeting Registration
  Main Lobby (3rd Floor), Thornton Hall

- Sunday May 4, 2003, 8:00 a.m.-10:50 a.m.
  Special Session on Beyond Classical Boundaries of Computability, III
  Room 329, Thornton Hall
  Organizers:
  Mark Burgin, University of California Los Angeles

mburgin@math.ucla.edu
Peter Wegner, Brown University pw@cs.brown.edu

- 8:00 a.m.
  On the complexity of real recursive functions.
  Manuel Lameiras Campagnolo*, Lisbon University of Technology
  (987-68-08)
- 8:30 a.m.
  Descriptive complexity in classes of inductive Turing machines.
  Mark Burgin*, UCLA
  (987-68-06)
- 9:00 a.m.
  If Intelligence is Uncomputable, Then...
  Peter Kugel*, Boston College
  (987-68-16)
- 9:30 a.m.
  Learning in the limit and experience of generations.
  Mark Burgin*, UCLA
  Allen Klinger, UCLA
  (987-68-31)
- 10:00 a.m.
  A formal model of fuzzy computations (preliminary report).
  Jiri Wiedermann*, Institute of Computer Science, Academy of Sciences of the Czech Republic, Prague
  (987-68-48)
- 10:30 a.m.
  On Asymptotic Decidability of Some Problems Related to Artificial Intelligence.
  Marek A Suchenek*, California State University Dominguez Hills
  (987-03-100)

- Sunday May 4, 2003, 8:00 a.m.-10:50 a.m.
  Special Session on Qualitative Properties and Applications of Functional Equations, III
  Room 326, Thornton Hall
  Organizers:
  Theodore A. Burton, Southern Illinois University at Carbondale
  taburton@olypen.com

  - 8:00 a.m.
    Fixed Points and Controllability in Delay Systems.
    Bo Zhang*, Fayetteville State University
    (987-34-99)
  - 8:30 a.m.

- Sunday May 4, 2003, 2:00 p.m.-2:50 p.m.
  Invited Address
  A problem in symmetric functions arising from phase determination in crystallography.
  Room 201, Science Building
  Joe P Buhler*, Reed College
  (987-12-198)

- Sunday May 4, 2003, 3:00 p.m.-6:00 p.m.
  Special Session on Beyond Classical Boundaries of Computability, IV
  Room 329, Thornton Hall
  Organizers:
  Mark Burgin, University of California Los Angeles
  mburgin@math.ucla.edu
  Peter Wegner, Brown University pw@cs.brown.edu

  - 3:00 p.m.
    A Logical Approach to the Philosophy of Hypercomputation.
    Selmer C Bringsjord*, Rensselaer Polytechnic Institute (RPI)
    (987-03-15)
  - 3:30 p.m.
    Turing's Thesis, Hume's Problem, and Ockham's Razor: Uncertainty, Simplicity, and Efficiency in Empirical and Formal Reasoning.
    Kevin T. Kelly*, Carnegie Mellon University
    (987-03-25)
  - 4:00 p.m.
    The Concept of Computability.
    Carol E. Cleland*, Philosophy Department, University of Colorado
    (987-03-47)
  - 4:30 p.m.
    Hypercomputation in the Real World.
    B. Jack Copeland*, University of Canterbury, New Zealand
    (987-03-126)
  - 5:00 p.m.
    Attempts to Compute the Uncomputable.
    Martin D Davis*, UC Berkeley
    (987-03-93)
  - 5:30 p.m.
    Round Table

- Sunday May 4, 2003, 3:00 p.m.-4:20 p.m.
  Special Session on Qualitative Properties and Applications of Functional Equations, IV
  Room 326, Thornton Hall
  Organizers:

987-68-11 **Peter Wegner*** (pw@cs.brown.edu), Department of Computer Science, Brown University, Providence, RI. *Turing's Life and Ideas.* Preliminary report.

Turing's rich contributions to computer science, including Turing Machines, the Entscheidungsproblem, Turing's Thesis, Enigma, ACE and AI, will be overviewed. Alan Turing besides his Turing Machines proposed other more powerful models of computation, because he saw limitations of his basic model. Apparently, he once again was too far ahead of his times, because theoreticians took only a small subset of his work to build on that foundations of current computer science. For many years this was su cient. Only now with the development of new powerful applications, it becomes evident that algorithms and Turing Machines do not provide a complete model for problem solving. We point out that Turing was not the author of so called strong Turing Thesis equatinq Turing Machines with all forms of computation. Thus an emotional resistance on the part of computer science community against new models of computation as violating Turing's ideas is based on shaky foundations. Turing himself was the rst who introduced models of computation more expressive than his original Turing Machines, i.e., c-machines, o-machines and u-machines. (Received December 12, 2002)

987-68-12 **Dina Goldin*** (dqg@cse.uconn.edu), Dept.of Computer Science and Engineering, University of Connecticut Storrs, Storrs, CT. *SuperTuring Models of Computation.* Preliminary report.

The need for models of computation more powereful than Turing Machines will be presented. To show that new models are a natural continuation of Turing ideas, but more powerful, we refer to them as performing superTuring computation. A few illustrating examples will demonstrate why Turing Machines do not cover all problem solving. After demonstrating the need for more powerful models of computation, the principles that allow to derive superTuring models will be described. We refer to them as the interaction, evolution and in nity principles. A few illustrating examples of superTuring models of computation will be presented. The overview of the state of art will be attempted. (Received December 12, 2002)

987-68-18 **Bruce J. MacLennan** (`maclennan@cs.utk.edu`), Department of Computer Science, The University of Tennessee, Knoxville. *Natural Computation and Non-Turing Models of Computation.* The Turing-machine model of computation is based on various oft-forgotten assumptions, which may not be appropriate in some important applications of computation. In particular, we argue that natural computation (computation based in information representation and processing in nature) makes di erent assumptions and asks di erent questions from those inherent in the TM model.

For example, the TM model assumes that information is represented in nite, discrete structures and that computation proceeds by discrete steps. Consequently, computations can be described by nite, discrete rules and implemented by universal machines.

In natural computation, in contrast, information is most naturally modeled as images in continuous spaces. Such a representation does not have a natural nite, discrete constituent structure that conforms to its meaning. Also, information processing in natural computation is continuous in both time and state-space. Further, the physical rate of computation and its resilience to error are both critical issues. Asymptotic time-complexity is less signi cant than the physical resources necessary to process in real-time a continuous input space of given dimension and bandwidth. (Received January 09, 2003)

987-68-13 **Eugene Eberbach*** (eeberbach@umassd.edu), Computer and Information Science Department, University of Massachusetts Dartmouth, North Dartmouth, MA 02747. *New Kind of Computer Science.* Preliminary report.

SuperTuring Computing may require to rewrite foundations, programming paradigms and architectures of computers. The Entscheidungsproblem, the Church-Roser theorem, the diagonalization language, the Post Correspondence Problem, the P = NP question, will be revisited in the context of superTuring models. The extensions of the Turing test for intelligence will be discussed. The need for new programming paradigms and computer architectures will be presented. The implementability issues will be addressed. At the end, the Godel's incompleteness will be re-visited in the context of superTuring computing. (Received December 12, 2002)

987-68-16 **Peter Kugel*** (kugel@bc.edu), Peter Kugel, Computer Science Department, Boston College, Chestnut Hill, MA 02467. *If Intelligence is Uncomputable, Then...*

If intelligence requires inductive inference, and I believe that it does, it may require procedures that do more than compute. But that need not put intelligence beyond the reach of today's computers. It may only mean that, if we want them to be intelligent, we will have to use them di erently. I want to show why making computers intelligent will require us to use them di erently and to raise two questions the answers to which could help us to do that: (1) "How can we determine the "intelligence" of algorithms for doing induction?" (This is a bit easier than measuring intelligence in humans, because we have access to the algorithms, but not easy.) (2) "How can we tell computers, executing such algorithms, what to 'think' of next?" (This is a bit harder than telling computational algorithms "what to think of next", but probably more interesting.) (Received January 06, 2003)

987-03-15 **Selmer C Bringsjord*** (selmer@rpi.edu), Department of Computer Science, Department of Cognitive Science, RPI, Troy, NY 12180. *A Logical Approach to the Philosophy of Hypercomputation.*

I'll con ne my remarks to three topics, viz.,

T1 frameworks and key propositions in a logical approach to a philosophy of hypercomputation

T2 the doctrine of what I call "supermentalism," essentially the view that human persons can harness hypercomputation

T3 some of my R&D in AI that proceeds on the assumption of supermentalism

Fuller treatment of topics T1–T2, and to some degree T3, can be found in some of my publications, e.g., (Bringsjord 1997, 2002, 2003).

References

Bringsjord, S. (1997) "Philosophy and 'Super' Computation," in Bynum, T. and Moor, J., eds., *The Digital Phoenix: How Computers are Changing Philosophy* (Oxford, UK: Basil Blackwell), pp. 231–252.

Bringsjord, S. & Zenzen, M. (2003) *Superminds: Persons Harness Hypercomputation, and More* (Dordrecht, The Netherlands: Kluwer).

Bringsjord, S. & Zenzen, M. (2002) "Toward a Formal Philosophy of Hypercomputation," *Minds & Machines* 12: 241–258.

Rado, T. (1963) "On Non-Computable Functions," *Bell System Technical Journal* 41: 877–884.

(Received December 23, 2002)

987-03-25 **Kevin T. Kelly*** (`kk3n@andrew.cmu.edu`), 5000 Forbes Avenue, Pittsburgh, PA 15207. *Turing's Thesis, Hume's Problem, and Ockham's Razor: Uncertainty, Simplicity, and E ciency in Empirical and Formal Reasoning.*

Church's thesis delimits fundamental limitations on algorithmic reasoning. Hume's problem concerns the empirical justi cation of universal laws by particular data. Ockham's razor is the principle that, when in doubt, one should choose the simplest theory compatible with current experience. What do these three ideas have in common? In both the empirical and the formal domains, one can transcend fundamental limitations on the reasoning powers of nite agents by replacing the idea of halting with a correct answer with the weaker concept of fallible convergence in the limit. But mere limiting convergence is a very weak sense of success. Hilary Putnam introduced the idea of bounding the number of retractions or mind-changes prior to convergence. Smith and Freivalds have extened this idea to trans nite ordinals. It can be demonstrated that in order to minimize her ordinal retraction bound, an empirical reasoner (formal or empirical) must conform to Ockham's razor at each stage of inquiry. Extensions of this result to classical statistical problems and to purely computational problems will be discussed. The ideas involved resemble Cantor-Bendixson rank and Kuratowski's di erence hierarchy. (Received January 24, 2003)

987-03-47 **Carol E. Cleland*** (`Cleland@colorado.edu`), Philosophy Department, CB 232, University of Colorado, Boulder, CO 80309. *The Concept of Computability.*

Alan Turing's analysis still dominates thought about computability. Introduced to solve Hilbert's Entscheidungsproblem, it initially faced two competitors, Herbrand-Gdel general recursiveness and Church's lambda-calculus. Turing demonstrated that these accounts are extensionally equivalent vis--vis the computation of the number-theoretic functions. Because Turing's analysis seemed closest to the intuitive idea of a human carrying out a numerical computation with pencil and paper, it was taken as capturing the intuitive idea. It didn't take long for Turing's analysis to be extended to computability in general. As Turing himself recognized, this is not a straightforward mathematical claim. It is a claim about the correct analysis of an informal, intuitive concept. In this talk, I explore the conceptual foundations of the neo-Turing analysis. I argue that it con ates some fundamentally di erent concepts, e.g., the idea of an "operation" or "action" that is "formal," "mechanical," "well-de ned," and "precisely described," and the idea of a "symbol" that is "formal," "uninterpreted," and "shaped". When these concepts are disentangled, the intuitive appeal of the neo-Turing account (as providing an analysis of the general concept of computability) is signi cantly undermined.

(Received February 20, 2003)

987-03-126 **B. Jack Copeland*** (`jack.copeland@canterbury.ac.nz`), Philosophy Dept, University of Canterbury, Private Bag 4800 Christchurch, New Zealand. *Hypercomputation in the Real World.*

Hypercomputation is the computation of functions or numbers that cannot be computed in the sense of Turing (1936), i.e. cannot be computed with paper and pencil in a nite number of steps by a human clerk working e ectively. This paper answers a number of philosophical objections to the idea of hypercomputation, including objections based on: - the Church-Turing thesis - the concept of mechanism - the meaning of 'computer' - epistemological di culties (how could one ever know that a device is a hypercomputer?) - the niteness of the real world - the Beckenstein bound. The paper also discusses the issue of whether Turing's 'o-machine' concept of 1938 was a precursor of the concept of hypercomputation. (Received March 09, 2003)

987-03-93 **Martin D Davis*** (martin@eipye.com), 3360 Dwight Way, Berkeley, CA 94704-2523. *Attempts to Compute the Uncomputable.*

Hava Siegelmann claims that her neural nets go "beyond the Turing limit". Jack Copeland proposes to harness Turing's notion of "oracle" for a similar purpose. Tien D. Kieu proposes a quantum mechanical algorithm for Hilbert's 10th problem, known to be unsolvable.It will be shown that in each case the results depend on the presumed physical availability of in nite precision real numbers. In the rst two examples, uncomputable outputs are obtained only by slipping uncomputable inputs into the formalisms. Kieu's method depends on a physically unrealizable form of adiabatic cooling. (Received March 05, 2003)

987-03-9 **Joel David Hamkins*** (`jhamkins@mathstat.gsu.edu`), Department of Mathematics and Statistics, Georgia State University, 30 Pryor Street, 7th oor, Atlanta, GA 30303. *Supertask computation with in nite time Turing machines.*

In nite time Turing machines extend the operation of ordinary Turing machines into trans nite ordinal time. By doing so, they provide a natural model of in nitary computability, a natural theoretical setting for the analysis of the power and limitations of supertask algorithms. In this talk, I would like to give an elementary introduction to the machines and to the computability theory to which they give rise. In particular, I will discuss a few alternative formulations of the machines, some structural theorems on the in nite time Turing degrees, the in nite time analogue of Post's problem and the recent solution of $P \neq NP$ in the in nite time context. (Received November 22, 2002)

987-03-14 **Benjamin Wells*** (`Wells@usfca.edu`), Department of Mathematics, 2130 Fulton Street, San Francisco, CA 94117. *Hypercomputation by De nition.* Preliminary report.

Let C be the class of computable problems, and let T be the class of Turing-computable problems. So the Church-Turing Thesis (CTT) is $C = T$. Expanders of CTT usually endow their machines with special powers to obtain T' T; others assert that C, T are incomparable, etc. A third approach is to describe a wider problem class C' C that includes problems having a claim to computability but clearly failing to be Turing computable. One such class comprises the quasirecursive equational theories, those that for every n have their set of true equations with n variables in T. Among these are theories not in T—the pseudorecursive theories introduced in [1] and discussed in [2]. Saying these new problems are computable yields *hypercomputation by de nition.* Analogues at other complexities are feasible and inspirational. Progress on an abstract framework for these problems will be described. One may ask whether reasonable machine extensions can match them.

[1] B. Wells, *Pseudorecursive varieties of semigroups—I*, Int. J. of Algebra and Computation **6** (1996), 457–510.

[2] B. Wells, *Is there a nonrecursive decidable equational theory?*, Minds and Machines **12** (2002), 303–326. (Received December 20, 2002)