Joseph E. Johnson, PhD

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I) Vita Information
  A) Education
    1) BA Vanderbilt University (Physics & Mathematics)
    2) MS State University of Iowa (Theoretical Physics)
    3) PhD State University of New York at Stony Brook (Theoretical Physics)
  B) Current Employment
    1) Professor of Physics – USC
    2) Research Scientist – University of Utah
    3) President & CEO of E811 Inc, ExaSphere Inc, 3IMS LLC
  C) Previous Employment
    1) Asst. & Assoc Dean of Science & Math & Assoc Chair of Physics - USC
    2) Assistant & Associate Professor - USC
    3) Instructor at SUNY & summer research at Brookhaven National Lab
  D) Related Sites
    1) www.asg.sc.edu
    2) www.e811.com
    3) www.exasphere.com
  E) Core Publications
    1) Position Operators & Proper Time in Relativistic Quantum Mechanics, Phys. Rev. Vol 181, No 5 1755-1764 May 1969
    2) Proper Time Quantum Mechanics II, Phys. Rev. D Vol 3, No 8, 1735-1747 April 1971 1755-1764 May 1969
    3) Remark on the Isospin Mass Differences, Phys. Rev. D Vol 3, No 11, 2648-2651, June 1, 1971
    4) Exact Diagonalization of the Dirac Hamiltonian in an External Field, Phys Rev D, Vol 10, No 8, 2421-2427 October 1974
    5) Markov-Type Lie Groups in GL(n,R) J. Math Phys. 26 (2) 252-257 February 1985
    6) Networks, Markov Lie Monoids, and Generalized Entropy, Computer Networks Security – Third International Workshop on Mathematical Methods, Models, and Architectures for Computer Network Security, St. Petersburg, Russia, September 2005, Proceedings, 129-135
  F) Publications in other areas:
    1) Income Elasticity of the Residential Demand for Electricity, Ronald P Wilder, Joseph E. Johnson, & R. Glenn Rhyne, The Journal of Energy & Development Vol 16, No 1, 1-13 Autumn 1990

2) Risk Factors for Traumatic Physical Injury During Sexual Assaults for Male and Female Victims, Ann L Coker, Lucille G Walls, & Joseph E. Johnson, Journal of Interpersonal Violence Vol 12, No 5, 605-620 October 1998

G) Patents & Copyrights
1) Apparatus and Method for Handling Logical and Numerical Uncertainty Utilizing Novel Underlying Precepts, US Patent 6,996,552 Feb 7, 2006
2) Entropy as a Network Metric, Provisional Patents Applied For Dec 2005
3) UNITS software – multiple copyrights 1984-2006

II) University Research & Development (USC contracts with Dr. Johnson as PI)
A) ASG: Director of the Advanced Solutions Group (ASG) at USC
   Information systems development with a professional software team using Oracle/DB2/SQL databases with JAVA, Struts, & advanced tools
   www.asg.sc.edu
   1) TIME – Threat Information Management Engine ($4M in grants & contracts)
   2) CJIS – Criminal Justice Information Systems ($7M in grants & contracts)
   3) Scientific Systems ($3M in grants & contracts)
      (a) Baruch Marine Data Management Systems
      (b) University Contract & Grant Management System
      (c) Unocal Biostratagraphic Data Management System
      (d) Economic Input Output Modeling – SPAWAR Contract
      (e) Automated Classroom Management Software for Self Paced Astronomy Program
      (f) Colon Cancer Data Management System
B) University Courses
   1) Lie Groups & Lie Algebras as a Foundation of Physics – Physics 729
      (a) Video Lectures
      (b) Notes to accompany video lectures
      (c) This is a one semester course for PhD level Physics majors that have already taken the primary graduate physics courses in classical, quantum, and electromagnetic theory. It develops the theories of relativity, quantum theory and field theory, and internal symmetries using Lie algebras and groups. It is a one semester course that develops the representations of the Heisenberg, Rotation, Lorentz, Poincare, Unitary (internal symmetry groups), Markov & general linear group and related physics including discrete symmetries and second quantization – all from the Lie group theory and Lie algebra point of view.
   2) Fundamentals of Physics – Physics 101-102, 201-201, 211-212
      (a) Video Lectures for Multiple Mathematical Levels:
         (i) Physics 101-102: Physics Science (descriptive & arithmetic level)
         (ii) Physics 201-202: General Physics (algebra-trig / pre-med etc)
         (iii) Physics 211-212: Essentials of Physics (calculus/ physics & eng.)
         (iv) Lectures for all three levels of this course are presented. These core lectures consist of modular recordings with accompanying notes at the three levels – lectures are video of voice with writing of the associated equations. The modules are of variable time lengths.

(b) Course notes for each level are available (both with & without hand notes)

(c) Classroom video capture of problem solving & lectures also available for:

    (i) Algebra/trig level classes with descriptive material

    (ii) Calculus/differential equation/linear algebra level classes

III) Major R&D Developed Initiatives

  A) ExaSphere – Network Analysis Engine – A foundational framework for networks.

    1) The use of the Markov transformations, Lie groups & algebras, information & generalized entropy functions, to understand networks in general and specifically to use generalized entropy functions as metrics for networks to characterize the topology and tracking of network behavior. Patents applied for. Funding of $2.5M over 4 years from DARPA.

    2) Commercial code is available www.exasphere.com

  B) Bittor – A foundational framework for Logical & Numerical Uncertainty

    1) A foundational theory that extends Boolean algebra and logic to a continuous structure based upon Markov monoid representations (bit vectors or bittors) in two (or higher) dimensions along with a mathematics that extends the fundamental binary numbers and associated arithmetic to provide for the automated management of numerical uncertainty, information loss in numerical operations, automated error management, and algorithms for multithreaded computation based upon probabilistic decisions.

    2) Patent held by J.E. Johnson PhD: Leasing is available: jjohnson@sc.edu

  C) UNITS – A Computational Environment in Web browsers & Excel.

    1) An algorithm for rapid computation of mathematical expressions involving units and special constants with automatic dimensional analysis.

    2) The system has been programmed both in a web environment (JavaScript) and in Excel spreadsheets. (Copyrighted 1984-2006)

    3) Commercial code in JavaScript & Excel is available: jjohnson@sc.edu

  D) A New Game Theory Environment

    1) A new kind of structure for game theory is proposed that is (a) more immediately applicable to real problems in business, investments, medicine, science, engineering, and military domains, (b) supports non-zero sum, n-person games with allowance of alliances in a computable system, and (c) is computationally tractable with convergent solutions to coupled nonlinear equations. The proposed system still uses players that make choices during each turn and receive a payoff as with standard von Newman game theory. Otherwise the framework differs. The base system proposed is based upon a question (of reasonable difficulty but not too difficult) which has a single string (alphanumeric word) correct answer. Self learning algorithms for expert opinion overlap are used to estimate the correct answer and information gained is used in developing the payoff (or reward). The payoff function is formed in terms of Shannon & Renyi' information metrics of information gain and market estimates of information value.

    2) Commercial code will be available in Fall 2006: jjohnson@sc.edu

IV) Major R&D Initiatives & Studies – Research In Progress
  A) Emergence of Local Order in a System with Globally Increasing Entropy
     1) Using Markov type Lie algebras & groups, it is shown how a system that has a natural tendency for increasing entropy and disorder, can have a subsystem that maintains order and information. Such systems are classified.
  B) General Network Structures and the General Linear Group – Advanced Analysis
  C) Information as an Observable in Quantum Theory with Connections Between Markov Monoids, Generalized Entropy & Information, the Direction & Irreversibility of Time, and Uncertainty Principles.
  D) The Use of Numerical Uncertainty, Information Theory, and Markov Groups, to Generalize Quantum Mechanical Observables which have Limited Information.
  E) Health Transitions in Continuous and Discrete Markov Transformations
  F) Symbol Structures in Information Systems
     1) Requisite symbols
     2) Requisite basic structure for information
     3) Requisite basic structure for information processing
  G) Entropy Limits Requirements on Quantum Theory