IMMANUEL FREEDMAN, Ph. D, SMIEEE, MInstP, CPhys

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Harleysville, PA 19438
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SUMMARY OF EXPERIENCE

Systems, Signals and Algorithms Consultant with over 30 years experience of video, imaging, modeling, simulation, and systems analysis, design, development, and testing. He has served as an expert consultant providing technical analysis related to patent infringement, patent validity, and the research tax credit.

EDUCATION

Ph. D., Physics, University of Durham, England, 1986
B.Sc. (Honors), Physics, University of Durham, England, 1979

LICENSES

Registered Patent Agent #51,704

EXPERIENCE

Takeda Pharmaceuticals **Cambridge, MA** **Mar '22-present**
Clinical Pharmacology Director

Dr. Freedman provides mathematical modeling of systems, signals, and images.

Freedman Patent **Harleysville, PA** **Oct '21-present**
Sole Proprietor

He provides consulting and expert witness services to industry and the legal profession.

State University of New York at Buffalo **Buffalo, NY** **Jun '17-present**
Volunteer Researcher

Praxis Precision Medicines **Boston, MA** **Aug '21-Sep '21**
Senior Director, Pharmacometrics

Dr. Freedman provided mathematical modeling of systems, signals, and images.

Daiichi Sankyo, Inc. **Basking Ridge, NJ** **Nov '20-Aug '21**
Director, Modeling and Simulation

Dr. Freedman provided mathematical modeling of systems, signals, and images.

Freedman Patent **Harleysville, PA** **Jun '16-Nov '20**
Sole Proprietor

He provided consulting and expert witness services to industry and the legal profession. In particular, he provided requirements analysis and design for a precision dosing system Graphical User Interface.

GlaxoSmithKline, Inc. **Upper Merion, PA** **Aug '07-Jun '16**
Manager, Clinical Pharmacology

Dr. Freedman provided mathematical modeling of systems, signals and images and participated in technical due diligence activities on demand.

Freedman Patent **Harleysville, PA** **Jul '05-Aug '07**
Sole Proprietor

He provided consulting and expert witness services to industry and the legal profession. In particular, he provided requirements analysis and design for a precision dosing system Graphical User Interface.

Merck & Co., Inc., **West Point, PA** **Nov '04-Jul '05**
Senior Research Fellow

Dr. Freedman provided mathematical models on demand.

Amgen, Inc. **Thousand Oaks, CA** **Apr '03-Mar '04**
Contractor

Dr. Freedman developed algorithms and software in MATLAB and FORTRAN for simulation and data modeling.

Cyra Technologies, Inc. **San Ramon, CA** **Nov '02-Apr '03**
Senior Hardware Engineer

Dr. Freedman designed, developed, and tested algorithms and software for calibrating a three-dimensional laser scanner. He calculated the statistical distribution of outcomes for an engineering tolerance stack by modeling and simulating the scanner response using a Jacobian sensitivity matrix to compare alternative placements of scanner calibration targets based on a D-matrix of scanner response.

Media Logic Systems Ltd. **Fleet, England UK** **Jan '00-Oct '02**
Chief Systems Engineer

Dr. Freedman designed and developed a novel live interactive television systems (iSeeTV) in which served as a User Interface for customer communication with human sales agents in video-enabled call centers implemented via television and telephone, deployed to 50,000 subscribers of Telewest, UK.

He researched and developed tools and encoder systems to optimize image quality at prescribed latency and bit rate for distributing live video and audio streams encoded via low latency methods including MPEG-2 Simple Profile at Main Level (CATV), MPEG-4 Visual Profile with background sprite coding, and H.263+ (now known as H.264).

Dr. Freedman investigated the feasibility of wavelet–based software encoding schemes with motion compensation and perceptual quantization described by the MPEG Standards Committee Interframe Wavelet Ad Hoc Group. He interfaced video streams via ATM transport to Telewest, UK regional CATV head-ends switched via Harmonic Narrowcast Gateways for distribution via Video On Demand or Near Video On Demand systems to customer's homes.

Replay Networks, Inc. **Mountain View, CA** **Dec'99-Jan '00**
Contractor

Dr. Freedman researched and developed a method of porting an application developed for a Digital Video Recorder in the embedded C software language to standard set top box (STB) middleware to eliminate high development and maintenance costs associated with developing

custom STBs. He optimized bit rate and encoder chip parameters to yield high-quality time-shifted MPEG-2 streams controlled by VCR-like consumer controls.

Sun Microsystems, Inc. **Cupertino, CA** **Mar '99-Nov '99**
Software Engineer (Contractor)

Dr. Freedman researched and developed a Distributed Component Object Model (DCOM) software interface between a TV Control Graphical User Interface and the Microsoft Broadcast Application Programming Interface (API) to improve the visual quality of interactive TV displays derived from UDP/IP datagrams synchronized with MPEG-2 audio/video packet data.

The software interface additionally resolved discontinuities in Presentation Timestamp according to a Normal Play Time defined by a Digital Storage Media –Command and Control standard.

He designed and implemented an API written in the pJava and Visual C++ software languages under the Windows CE operating system for the Motorola DCT 5000+ DTV Set Top Box based on the Advanced Television Systems Committee digital television standard.

Rockwell Collins, Inc. **Pomona, CA** **Oct '98-Mar '99**
Lead Systems Engineer (Contractor)

As Lead Systems Engineer with a two-engineer span of control, Dr. Freedman timely delivered harmonized requirements for an MPEG-2 in-flight entertainment system similar to a cable television system based on an advanced intranet implemented on an aircraft.

He trained his team to use a Rational Unified software development process based on a Spiral Development Model implemented in the Universal Modeling Language using the Rational/Rose 98i Computer Aided Software Engineering tool.

Stratagene, Inc. **La Jolla, CA** **Aug '98-Oct '98**
Engineer (Contractor to Permanent)

Dr. Freedman evaluated frame grabber hardware for resolution and quality of time-integrated imagery and specified algorithms including cluster analysis and trending, further developing a user interface for a digital image processing system supporting gene-cloning science.

United Advanced Technologies, Inc. **Long Beach, CA** **Feb '98-Aug '98**
Firmware Engineer (Contractor)

Dr. Freedman analyzed and developed a nine-camera remote surveillance system with a Graphical User Interface developed in the Visual C++ software language under a Microsoft Windows operating system host and firmware developed in the embedded C software language implemented on Analog Devices' ADV601 wavelet video hardware.

He researched and developed Video for Windows parameters and on-chip settings for video quality control to deliver full-frame video over Plain Old Telephone Service telephone lines at quality acceptable to retail store security services.

KeyInfo Services, Inc. **Spring Valley, CA** **Mar '98-May '98**
Database Consultant

Dr. Freedman administered a database for providing web-based information developed in the Sybase SQL software language.

Mitek Systems, Inc. **San Diego, CA** **Aug '97-Jan '98**
Engineer (Contractor)

Dr. Freedman researched and developed an Intelligent Character Recognition digital image processing system based on neural nets implemented in the C software language to read handwritten checks and paper forms with about 80% accuracy on a real-time system deployed throughout the banking industry.

He researched and developed algorithms based on mathematical morphology implemented via neural nets to verify handwritten signatures on printed checks.

Symbionics Ltd. **Cambridge, England UK** **Aug '97**
Principal Engineer (Temporary)

Dr. Freedman analyzed manpower estimates for design, development and testing of an MPEG-2 interactive television set-top box based on an OpenTV interactive television standard implemented for the "Open…." television commerce system deployed Spring 1999 in the United Kingdom.

VideoActive/HCR, Inc. **Yorba Linda, CA** **Jan '97-Dec '97**
Contractor

Dr. Freedman reviewed, analyzed and developed proprietary disk layout software coded in the Visual C++ software language for a Near Video on Demand system delivering movies over telephone systems such as Asymmetric Digital Subscriber Lines (ADSL).

Dr. Immanuel Freedman, Inc. **Harleysville, PA** **Mar '96-Jan '16**
President

He provided technical consulting services to industry.

Anugraha **La Jolla, CA** **Jan '96-Jan '97**
Sole Proprietor

Dr. Freedman researched and developed algorithms and processes to compress fine art photography at image quality acceptable to artists based on the JPEG imaging standard implemented with image pre-processing and adaptive quantization.

Armor Safe Technologies, Inc. **Vista, CA** **Sep '95-Mar '96**
Firmware Engineer (Contractor)

Dr. Freedman developed an ARINC RS422/RS485 serial link communications software component written in the embedded C software language for a major confidential client specialized in retail store security. His timely software delivery enabled the client to capture a firm order with additional future potential.

Comstream, Inc. **San Diego, CA** **Jul '96-Aug '96**
Firmware Engineer (Contractor)

Dr. Freedman integrated a MPEG-2 set top box with OpenTV interactive television middleware programmed in the Microtec C language ported to a Motorola 68340 processor under the pSOS operating system. He implemented native bindings of the middleware for the On-Screen Display (Graphical User Interface) and communications stack.

General Instrument, Inc. **San Diego, CA** **Dec '95-May '96**
Senior Staff Engineer

Dr. Freedman reviewed and evaluated methodologies, design and development and performance models for the DigiCipher 2 cable television conditional access system. He migrated a subscriber authorization system written in the C++ language from a DEC Alpha computing platform under the OpenVMS operating system to a Sun SPARCstation computing platform under the Solaris operating system.

Optivision, Inc. **Davis, CA** **Mar '95-Sep '95**
Consultant

Dr. Freedman researched and developed rate control algorithms and software based on MPEG -2 Test Model 5 for the OPTIVideo MPEG-2 video encoder written in the Visual C++ and C software languages.

He researched and developed adaptive quantization algorithms based on a JPEG-3 draft standard for possible inclusion in the draft National Imagery Transmission Format imaging standard.

He researched and developed algorithms to improve the quality of gray scale image compression for the medical imaging DICOM Standard by providing a lossless hybrid algorithm encoding image residuals with a diagonal Golomb code based on an Enhanced Universal Trellis Coded Quantization algorithm.

Federal National Mortgage Association **Washington, DC** **Jul '94-Jan '95**
Software Engineer (Contractor)

Dr. Freedman designed and developed a Graphical User Interface to monitor and validate loan servicer input for the Loss Mitigation Project. He developed the software in the C software language for a Sun SPARCstation 2 platform under a UNIX operating system.

Hughes STX Corporation **Greenbelt, MD** **Sep '88-Jun '94**
Senior Systems Engineer

As Spacecraft and Attitude Analyst for a mission to map the relict radiation from the Big Bang at near infrared, far infrared and microwave wavelengths, Dr. Freedman developed, simulated and calibrated the Cosmic Background Explorer (COBE) Attitude Determination System to yield a stable solution for the spacecraft orientation at a quality factor of 2 above customer's expectation. This solution included a quaternion estimator implemented via an Extended Kalman Filter.

He developed, calibrated and simulated the COBE spacecraft subsystem and provided graphical and statistical analysis of the spacecraft telemetry-word database. When a gyroscope failed during the Launch and Early orbit mission phase, he responded rapidly by plotting graphs of the thermal subsystem telemetry until he found a possible cause of failure.

Dr. Freedman developed a spatially referenced database based on a quad-tree data structure, which stored scientific data for comparison of sky maps from COBE with sky maps from other missions that served as a diagnostic user interface for the Diffuse Infrared Background Experiment.

For the COBE mission, he led the systems engineering and end-to-end development of a novel system for compressing data that combined scientific modeling with statistical data compression. He proposed the system concept and prepared the system level specification, design and project schedule. With a team of two engineers, Dr. Freedman tuned the compression system performance to yield a throughput greater than uncompressed data processing with a compression factor of 22-90%. He further designed and developed evaluation tools to ensure the

user- transparent system-wide compression of a 380GB dynamic data base at image quality acceptable to scientists.

University of Maryland **College Park, MD** **Jun '87-Sep '88**
Research Associate

Dr. Freedman researched and developed digital image methods to process terrain models for a combat information processor sponsored by Battelle. It was developed in the C software language on Sun Microsystems workstation for porting to a supercomputer under a UNIX operating system.

He designed low-complexity algorithms for filtering, segmenting, clustering, and path planning based on digital images organized by quad-tree data structures.

University College London **London, England UK** **Sep '86-Jun '87**
Research Assistant

Dr. Freedman developed digital image processing algorithms to improve image and stereo-matching quality for a digital terrain modeling system based on satellite data.

As part of a UK Government Fifth Generation computing project (Alvey MMI-237) in collaboration with Thorn EMI, Royal Signals and Radar Establishment, and Laser Scan Ltd., he developed software and algorithms for affine transformation, edge filtering, kriging interpolation and image stereo matching with sub-pixel acuity.

Laser-Scan Ltd. **Cambridge, England UK** **Sep '85-Sep '86**
Software Engineer

Dr. Freedman researched and developed algorithms based on the mathematics of tessellation for efficient manipulation of spatially referenced data on serial computers and transputer arrays for a UK Government Fifth Generation computing project (Alvey MMI-237) in collaboration with Thorn EMI, Royal Signals and Radar Establishment, and Laser Scan Ltd.

National Coal Board **Nuneaton, England UK** **Nov '82-Sep '84**
Scientist (Management Grade 7)

For a Health and Safety project, Dr. Freedman developed and validated a microcomputer system to detect coalmine fires and heatings. Based on stochastic and temporal analysis of infrared data obtained via a tube bundle system, and telemetry data from underground thermocouples, the system detected growing trends of carbon monoxide concentration in the presence of noise from underground events such as blasting, diesel engine fumes, ventilation changes, and seismic activity.

PUBLICATIONS

Freedman, I. (2023), "Chaos Synchronization and the Guaranteed Convergence of Estimators of Nonlinear Dynamical Systems," IEEE Philadelphia Section event, December 19, 2023

Freedman, I. (2023), "The Intellectual Heritage of Babylonian Astronomy: Music of the Spheres," IEEE Philadelphia Section event, December 5, 2023

Freedman, I. (2023), "The Intellectual Heritage of Babylonian Astronomy: Music of the Spheres," in *The Intellectual Heritage of the Ancient Near East. Proceedings of the 64th Rencontre Assyriologique Internationale and the 12th Melammu Symposium,* eds. Rollinger, R. et al., pubs. Austrian Academy of Sciences Press: Vienna Austria 2023. ISBN 978-3-7001-8574-1

Freedman, I. (2021), "Modern Methods of Chaos and Babylonian Mathematical Astronomy," Ronin Institute Public Seminar, https://www.youtube.com/watch?v=KIfNFzK8dyI

Freedman, I. (2021), "On ^{mul} SAG.ME.GAR," NABU 2021-2, Nr. 52

Wilkins, J. et al. (2019), ISoP Position Statement on "Guidance Document: Population Pharmacokinetics: July 2019", Docket No. FDA 2019-D-2398

Freedman, I. (2019), "Chaos Synchronization: Identifying & Predicting Noisy Complex Systems," in AAPS Forum to Connect Predictive Modelers, May 6-7, 2019, Boston MA

Pillai, N. et al. (2019), "Estimating parameters of nonlinear dynamic systems in pharmacology using chaos synchronization and grid search," Journal of Pharmacokinetics and Pharmacodynamics, 46(2), 193-210

van Oordt, C. W. M. H et al. (2018), "ImmunoPET imaging to assess target engagement: Experience from 89Zr-anti-HER3 mAb (GSK2849330) in patients with solid tumors", J Nucl Med jnumed.118.214726 published ahead of print February 7, 2019

Norris, D. et al. (2018), "Expansion Cohorts: Use in First-In-Human Clinical Trials To Expedite Development of Oncology," submitted to FDA, FDA-2018-D-2777-0001, DOI 10.17605/OSF.IO/NMGH8

Freedman, I. (2018), "IEEE Digital Health Standards," at FIS Global , November 27, 2018, Collegeville: PA

Freedman, I. (2018), "Chaos Synchronization: Estimating Parameters of Noisy Complex Systems," in IEEE Section Night, October 20, 2018, Philadelphia: PA

Schieke, M. & Freedman, I. (2018), "3D Topological Mapping of Macroanatomy and Microanatomy for Use in Big Data and Augmented Intelligence Systems," in IEEE-Standards Association Workshop on Digital Health Standards, September 11, 2018, Atlanta: GA

Freedman, I. (2018), "The Intellectual Heritage of Babylonian Astronomy: Music of the Spheres," presentation in *Rencontre Assyriologique Internationale 64*, July 14-20, 2018, Innsbruck Austria

Pillai, N. et al. (2018), "Chaos synchronization and Nelder-Mead search for parameter estimation in nonlinear pharmacological systems: estimating tumor antigenicity in a model of immunotherapy," PBMB Special Issue Volume 139, November 2018, Pages 23-30

Pillai, N. et al. (2018), "Estimating parameters of chaotic systems: chaos synchronization combined with Nelder-Mead search, " in PAGE 2018: May 31, 2018, Montreux CH

O'Connor, M. A. et al. (2017), "Elucidating Exposure-Response (Safety and Efficacy) of Adct-402 (Loncastuximab Tesirine), a Novel Pyrrolobenzodiazepine-Containing Antibody Drug Conjugate, for Recommended Phase 2 Dose Determination in Patients with Relapsed or Refractory Non-Hodgkin Lymphoma," in American Society of Hematology 59th Annual Meeting & Exposition, Atlanta GA Dec 9-12, 2017

Freedman, I., Bies, R. R., Pillai, N., Schwartz, S., Ho, T. (2017), "Estimating parameters of chaotic systems in pharmacology", invited talk in American Conference on Pharmacometrics 8, Oct 14-19, 2017, Ft. Lauderdale: FL

Nguyen, T-H-H et al. (2016), Model evaluation of continuous data pharmacometric models: metrics and graphics, CPT Pharmacometrics Syst Pharmacol. 2017 Feb; 6(2): 87–109

Freedman, I., Bies, R. R., Pillai, N. (2016), "Estimating parameters of chaotic systems," in American Association of Pharmaceutical Scientists Annual Meeting and Expositions, November 13-17, 2016, Denver CO

Freedman, I. (2016), "Babylonian astronomers predicted lunar and planetary positions using iterated maps, forerunners of deterministic chaos," in Rencontre Assyriologique Internationale 62, July 11-15, 2016, Philadelphia PA

Cataloluk, O. & Freedman, I. (2016), "The meaning of *armannu*," in Rencontre Assyriologique Internationale 62, July 11-15, 2016, Philadelphia PA

Freedman, I., Bies, R. R., Ho, T. (2015), "Estimating parameters for chaotic systems," in GlaxoSmithKline Biostatistics Annual Conference, November 13, 2015, Upper Providence PA

Freedman, I. (2015), "A QSP model for cancer incorporating HER-3," in GlaxoSmithKline Quantitative Systems Pharmacology Day, October 29, 2015, Upper Merion PA

Freedman, I. (2015), "Imaging & Microdialysis: Complementary Modalities?" invited panelist, in American Association of Pharmaceutical Scientists Annual Meeting and Exposition, October 24-29, 2015, Orlando: FL

Freedman, I. (2015), "On MA.NA EN.NUN in ^{mul}APIN," NABU 2015-2 Nr. 50

Freedman, I. (2015), "The Marduk Star Nēbiru," Cuneiform Digital Library Bulletin 2015:3, retrieved from http://cdli.ucla.edu/files/publications/cdlb2015_003.pdf

Freedman, I. (2015), "Short Note: On an Assyriological Interpretation of the Book of Daniel 5:1–28," Journal of Translation 11(1), 74

Bies, R. R., Ho, T. & Freedman, I. (2015), "Nonlinear dynamic physiological systems: Chaos Synchronization as an approach to parameter estimation" in *Kinetic and Dynamic Complexity in Drug Transit-Response in the Human Body*, satellite meeting to Population Approach Group Europe 2015, June 2, 2015, Hersonissos: GR

Freedman, I. (2015), "On an Assyriological interpretation of Constantine's *labarum*" retrieved from http://www.researchgate.edu

Freedman, I. (2015), "Model Evaluation and Selection," invited talk to American Association of Pharmaceutical Sciences Pharmacometrics Focus Group, March 26, 2015

Freedman, I., Moyer, B.R & Cheruvu, N.P.S. (2014), "Pharmaco-Imaging", in American Association of Pharmaceutical Sciences Translational Sciences 101 e-learning course, retrieved from http://www.aaps.org/TS101/

Freedman, I. (2014), "Role of Pharmacology in Anti-Cancer Antibody Development," invited talk, in American Association of Pharmaceutical Scientists Annual Meeting and Exposition, Nov 2-6, San Diego: CA

Willis, S. et al. (2014), "Martha Meets Shakespeare," musical performance, retrieved from http://www.youtube.com/

Austin, D., Freedman, I., Grove, R, Tolson, J. & Vanmeter, S. (2014), "The Relationship Between Peripheral B-Cell Levels and MRI Disease Activity in Relapsing-Remitting Multiple Sclerosis (RRMS)", dual presentation in American Academy of Neurology 66th Annual Meeting, Philadelphia: PA

Freedman, I. (2014), "On horses and bitumen in mulAPIN," NABU 2014-1 Nr. 33
Freedman, I. (2014), "Pharmaco-Imaging in Translational Science and Research," in Pharmaco-Imaging in Drug and Biologics Development (Moyer, B.R., Cheruvu, N.P.S. & Hu, T. C.-C., eds.), Springer, Inc.

Freedman, I. & Bies, R. (2013),"Chaos Synchronization," invited talk, in 3rd Annual Indiana Clinical and Translational Sciences Institute Symposium on Disease and Therapeutic Response Modeling, Nov 5-6, 2013, Indianapolis, IN

Freedman, I. (2013), "Translational pharmacometric models of anti-cancer antibodies," invited talk, in 2nd International Conference on Translational & Personalized Medicine, Aug 5-7, 2013, Chicago IL

Freedman, I. (2013), "Writing on the Wall–Conspiracy in Babylon?" retrieved from http://www.researchgate.edu

Willis, S. et al. (2013), "Amy's Suite," musical performance, retrieved from http://www.youtube.com/

Freedman, I. (2012), "Case Studies in the Use of Imaging Agents in Proof-of-Concept and Early Proof-of-Efficacy Trials," invited talk, in National Biotechnology Conference, May 21-24, 2012, San Diego: CA

Freedman, I. (2012), "Regulatory Opportunities and Hurdles with Imaging Agents in the Era of Personalized Medicine," invited panelist, in National Biotechnology Conference, May 21-24, 2012, San Diego: CA

Freedman, I. (2012), "Translating Clinical and Pre-Clinical Information into Success," invited talk, in 3rd World PK/PD Summit, March 27-29, 2012, Boston: MA

Freedman, I. (2012), "Improving Integration of PK/PD Modeling into the Drug Development Process," invited panelist, in 3rd World PK/PD Summit, March 27-29, 2012, Boston: MA

Freedman, I. (2011), "The Impact of 3D Tissue Models on Drug Development and Predictive Safety," invited panelist, in Predictive Functional Tissue Models, November 17-18, 2011, Boston: MA

Derosier, F.J. et al. (2012), "Novel Uses," WIPO Publication WO2012096924 A1, priority date Jan 10, 2011

Freedman, I. (2011), "System for forecasting outcomes of clinical trials," United States Patent Application Publication 20110238317A1, priority date Aug 9, 2007.

Freedman, I. (2011), "Case Study–Optimizing Design of a Phase 2 Clinical Trial in Relapsing-Remitting Multiple Sclerosis," invited talk in Joint Statistical Meetings 2011, Miami FL July 30-August 4, 2011

Freedman, I. (2011), "Case Study–Bridging from Western to East Asian Population in Accordance with ICH E5," in American Conference on Pharmacometrics 2011, San Diego CA April 3-6, 2011
Larkin, J. et al. (2010), "Osteoarthritis Disease Modification Potential of GSK2394002" in GlaxoSmithKline Clinical Pharmacology Symposium, Philadelphia PA June 15, 2010

Larkin, J. et al. (2010), "ADAMTS-5 Neutralizing Monoclonal Antibody: Translational Pharmacology Approach Provides Reason to Believe," in GlaxoSmithKline Clinical Pharmacology Symposium, Philadelphia PA June 15, 2010

Freedman, I et al. (2009), "Bayesian Parametric Schild Analysis from a Whole Blood Stimulation Assay," in American Conference on Pharmacometrics 2009, Mystic CT October 4-7, 2009

Freedman, I. (2009), "Feasibility of Immunogenicity Assessment based on Models of Polyclonal Anti-Drug Antibody Immunodynamics," in American Conference on Pharmacometrics 2009, Mystic CT October 4-7, 2009

Austin, D. J., et al. (2008), "Translational Pharmacology from a Domain Antibody First Time in Human Study," in SciNovations Symposium, Verona IT, September 26, 2008

Freedman, I. (2007), "Video Compression," in The Handbook of Computer Networks (Hossein Bidgoli, ed.), John Wiley & Sons, Inc.

Freedman, I. (2006), "Examination on Challenge: A Proposal for Improving the Patent System", *Disclosure*, Jan 2006 retrieved from http://www.napp.org

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Freedman, I. (2004), "Video," in Encyclopedia of Human-Computer Interaction (William Sims Bainbridge, ed.), Berkshire Publishing Group LLC

Freedman, I. (2003), "Video Compression," in The Internet Encyclopedia (Hossein Bidgoli, ed.), John Wiley & Sons, Inc.

Freedman, I. (2002), "Comparison of algorithms for efficient approximation of heterogeneous multidimensional scientific data," Astronomical Data Analysis II. (Starck, J-L; Murtagh, F D, ed.) in Proc. SPIE, Volume 4847, pp. 313-321

Freedman, I. (1999), "Proposal for Preliminary Evaluation of an Approximate Data Compression Algorithm for the FITS Standard," BAAS, 194

Freedman, I. and Farrelle, P. M. (1996), "Systems Aspects of COBE Science Data Compression," ASP Conf. Ser. 101: Astronomical Data Analysis Software and Systems V

Sodroski T. et al. (1995), "The Ratio of H_2 Column Density to ^{12}CO Intensity in the Vicinity of the Galactic Center," Ap. J. 450

Freedman, I., Boggess, E. & Seiler, E. (1992), "COBE Science Data Compression," BAAS, 24
Freedman, I., Skard, J. A.J. & Kelsall, T. (1992), "COBE/DIRBE Sky Map Trending," in ASP Conf. Ser. 25: Astronomical Data Analysis Software and Systems I

Freedman, I., Raugh, A. C. & Cheng, E. S. (1992), "COBE Astronomical Databases," in ASP Conf. Ser. 25: Astronomical Data Analysis Software and Systems I

Freedman, I. et al. (1991), "COBE ground segment gyro calibration," in NASA Flight Mechanics/Estimation Theory Symposium

Kumar, V.K. et al. (1991), "COBE ground segment attitude determination," in NASA Flight Mechanics/Estimation Theory Symposium

Wright, E.L. et al. (1991), "COBE attitude refinement," in AIP Conf. Proc. 222: After the first three minutes

Wright, E. L. et al. (1989), "The COBE Attitude Determination System," BAAS 21

Jackson M. J. et al. (1986), "Efficiency of tesseral arithmetic for 2.5D image manipulation on serial computers and transputer arrays," in S.B.M. Bell and B.M. Diaz (eds.) Spatial Data Processing using Tesseral Methods, pp. 353-364.

Dogiel V. et al. (1983), "Can Cosmic Rays be Accelerated in Collapsing Molecular Clouds?" Proc. 18th International Cosmic Ray Conference, 2

Giler, M. et al. (1980), "A limit to the velocity of convection of cosmic rays out of the Galaxy," Proc. 16th International Cosmic Ray Conference, 2

Freedman, I. et al. (1980), "Derivation of the age distributions of cosmic rays in a Galaxy with a convective halo," AAP, 82

PROFESSIONAL AWARDS

Takeda Pharmaceuticals Recognition Awards (2022, 2023)

Daiichi Sankyo Recognition Award (2021)
Funaro Award (2015, 2018)
GlaxoSmithKline R&D Recognition Award (2012, 2013, 2016)
NASA Group Achievement Award (1990, 1992)
Hughes STX Achievement Award (1990)
IBM Fulcrum Award (1988)

PROFESSIONAL AFFILIATIONS

Institute of Electrical and Electronic Engineers (Senior Member; Chair, Communications & Information Theory Chapter, Philadelphia Section; 2018/2019 Vice-Chair, P2673 Standards Working Group; Trusted Analytic Exchange Sub-Group Chair, P2795 Standards Working Group; Member P1900.8 Standards Working Group; Former Secretary, Dynamic Spectrum Access Machine Learning Study Group)
Institute of Physics (Chartered Physicist)
American Association of Pharmaceutical Scientists (Former Chair, Pharmaco-Imaging Community; Former Chair, Predictive Modeling Community; 2017 Member, Predictive Modeling Task Force)
International Society of Pharmacometrics (Former Member Standards and Best Practices Committee Member–Model Evaluation Group)
Regulatory Affairs Professionals Society
International Biometric Society (Eastern North American Region)
International Association for Assyriology
National Coalition of Independent Scholars
Ronin Institute for Independent Scholarship (Research Scholar)
Royal Society of Medicine (Fellow Member)

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