UNIVERSITATEA DE VEST DIN TIMIŞOARA

DOCTOR HONORIS CAUSA SCIENTIARUM

Prof. Dr. James Harold Davenport

Department of Computer Science
University of Bath, England

September 5, 2019

Timişoara, Romania

Cuvânt

la deschiderea ceremoniei de acordare a titlului de

DOCTOR HONORIS CAUSA SCIENTIARUM

al Universităţii de Vest din Timişoara

Domnului prof. univ. dr. James Harold DAVENPORT

Stimate domnule profesor James H. Davenport,
Stimaţi membri ai comunităţii academice,
Stimaţi invitaţi,
Dragi studenţi,
Onorat auditoriu,

Comunitatea academică a Universităţii de Vest din Timişoara este preocupată constant de promovarea şi recunoaşterea meritelor ştiinţifice ale marilor personalităţi ale lumii ştiinţifice. Astăzi ne simţim onoraţi să-l avem printre noi pe profesorul James Harold Davenport, care deţine poziţia de profesor Hebron and Medlock în Tehnologia Informaţiei la Universitatea din Bath, Anglia.

Profesorul James Davenport este o figură marcantă în domeniul algebrei computaţionale. A realizat progrese de pionierat în dezvoltarea algoritmilor de integrare simbolică şi a adus contribuţii remarcabile la calculul cu funcţii multivalente şi la înţelegerea complexităţii algoritmilor de eliminare a cuantificatorilor în câmpuri reale închise. Cele mai recente iniţiative ale domniei sale vizează stimularea colaborării dintre comunităţile ştiinţifice care lucrează în verificarea satisfiabilităţii şi în calculul simbolic, şi este de aşteptat ca această colaborare să aibă o influenţă durabilă asupra a ceea ce poate oferi informatica în modul de soluţionare a problemelor complexe.

Este un cercetător prolific cu un număr impresionant de publicaţii: şapte cărţi, incluzând o monografie despre integrarea funcţiilor algebrice, şi peste 140 de articole recenzate în reviste internaţionale prestigioase şi în proceedings-uri de conferinţe, care au fost citate de peste 4000 de ori.

Pe lângă contribuţiile sale remarcabile în cercetare, profesorul James Davenport este, de asemenea, un lider al proiectului OpenMath, un efort internaţional de standardizare a reprezentării obiectelor matematice cu semantica lor şi de facilitare a schimbului de informaţii matematice, prin iniţiative precum baza de date OpenMath. În prezent este vicepreşedinte al societăţii OpenMath, al cărui obiectiv principal este să reunească creatori de instrumente matematice, furnizori de software, editori şi autori.

A fost invitat să ţină prelegeri în peste treizeci de ţări şi la zeci de întâlniri internaţionale. Din 2009, este un vizitator constant al Universităţii de Vest din Timişoara, susţinând prezentări invitate şi jucând un rol activ în organizarea Simpozionului Internaţional de Algoritmi Simbolici şi Numerici în Calculul Ştiinţific, care este organizat şi găzduit în fiecare an de către Departamentul de Informatică al universităţii noastre.

De-a lungul timpului, profesorul James Davenport a deţinut numeroase funcţii de prestigiu în societăţi academice şi organizaţii internaţionale. Lista este impresionantă, aşa că le voi menţiona doar pe următoarele:

- Membru al British Computer Society (din 2007) şi al Academiei acestei societăţi (din 2010). În prezent, este vicepreşedinte şi Chair al Academiei, şi membru al Consiliului de Administraţie.
- Membru al Institutului de Matematici Aplicate (din 1987). În prezent, reprezintă acest institut în comitetul de informatică al Societăţii Matematice din Londra.
- Membru al Consiliului Consultativ Ştiinţific al Bibliotecii Europene Digitale de Matematică, din partea Societăţii Europene de Matematică.

Sperăm sincer că titlul acordat astăzi de Senatul Universităţii de Vest din Timişoara va avea un loc de seamă printre celelalte semne de recunoaştere acordate profesorului James Davenport pentru remarcabilele sale realizări profesionale.

Stimate domnule profesor dr. James Harold Davenport,

Suntem încântaţi că Universitatea de Vest din Timişoara are ocazia să vă răsplătească excelenta activitate ştiinţifică şi rezultatele remarcabile obţinute în domeniile matematicii şi informaticii, prin decernarea titlului de **Doctor Honoris Causa Scientiarum**.

În numele membrilor comunităţii academice, doresc să exprim consideraţia noastră profundă şi să vă urez multă sănătate şi putere de muncă, astfel încât să vă puteţi continua activitatea ştiinţifică cu aceeaşi energie şi pasiune neobosită.

Prof. univ. dr. Marilen-Gabriel Pirtea

Rectorul Universităţii de Vest din Timişoara

Address

at the opening ceremony for awarding the title of

DOCTOR HONORIS CAUSA SCIENTIARUM

of the West University of Timişoara

to prof. univ. dr. James Harold DAVENPORT

Dear Professor James H. Davenport,
Distinguished members of the academic community,
Dear guests,
Dear students,
Ladies and Gentlemen,

The Academic community of West University of Timişoara is constantly concerned of promoting and recognizing the scientific merits of the great personalities of the scientific world. Today, we feel honored to have with us Professor James Harold Davenport, the Hebron and Medlock Professor of Information Technology at the University of Bath in Bath, England.

Professor James Davenport is a leading figure in the field of computer algebra. He made pioneering advances in the development of algorithms for symbolic integration, and brought outstanding contributions to computation with multivalued functions, and in the understanding of the complexity of algorithms for quantifier elimination over real closed fields. His most recent initiatives aiming to stimulate the collaboration between the scientific communities working in Satisfiability Checking and Symbolic Computation are expected to have a lasting influence on what computer science can deliver in the way of solving complex problems.

He is a prolific researcher with an impressive number of publications: seven books, including a monograph on the integration of algebraic functions, and over 140 refereed articles in highly ranked international journals and conference proceedings, with more than 4000 citations.

In addition to his remarkable research contributions, Professor James Davenport is also a leader of the OpenMath project, an international effort to standardize the representation of mathematical objects with their semantics, and to facilitate the interchange of mathematical information, through such initiatives as the OpenMath database. He is now vice-president of the OpenMath Society, whose main goal is to bring together mathematical tool builders, software suppliers, publishers and authors.

He has been invited to lecture in more than thirty countries and dozens of international meetings. Since 2009, he is a constant visitor of the West University of Timişoara, giving

invited talks and playing an active role in the organization of the International Symposium of Symbolic and Numeric Algorithms for Scientific Computing, which is organized every year by the Department of Computer Science of our university.

Over time, Professor James Davenport has held many prestigious positions in academic societies and international organizations. The list is impressive, and I only wish to mention the following:

- Fellow of the British Computer Society (since 2007) and member of the British Computer Society Academy (since 2010). Currently, he is Vice-President and Academy Chair and member of the Trustee Board.
- Fellow of the Institute for Mathematics and its Applications (since 1987). Currently, he represents this institute on the London Mathematical Society's Computer Science Committee.
- Member of the Scientific Advisory Board of the European Digital Mathematical Library on behalf of the European Mathematical Society.

We sincerely hope that the title awarded today by the Senate of the West University of Timişoara will have an important place between the other signs of recognition for his outstanding professional achievements.

Dear professor dr. James Harold Davenport,

We are delighted that the West University of Timisoara has the opportunity to reward your excellent scientific activity and your remarkable results in the fields of mathematics and computer science, by offering you the title of **Doctor Honoris Causa Scientiarum**.

On behalf of the academic community, I wish to express our deep consideration, and wish you good health and power of work so that you can continue your scientific activity with the same relentless energy and passion.

Prof. univ. dr. Marilen-Gabriel Pirtea

Rector of the West University of Timişoara

LAUDATIO

In honour of
Prof. Dr. James Harold DAVENPORT
upon awarding the title of
DOCTOR HONORIS CAUSA SCIENTIARUM

Honourable Rector,
Mr. President of the WUT Senate,
Members of the Academic Community,
Distinguishd Guests,

A major progress in scientific computing happened in the 1970s, with the advent of computer algebra systems which aimed to overcome the usual limitation of computing with *approximate* numerical values. Computer algebra, a main field of symbolic computation, is based on the study and development of algorithms and software for manipulating mathematical expressions and other mathematical objects, and emphasizes *exact* computation with variables manipulated as symbols. Nowadays, the activities of professionals in scientific fields such as computer science, mathematics, engineering, and physics are almost impossible without using a system based on computer algebra.

We are now in a position to express our full appreciation and sincere admiration for a pioneer in the field of computer algebra systems and a currently world-wide recognized expert in the field of symbolic computation: professor James Harold Davenport from the University of Bath, England.

Professor James Davenport received his Ph.D. in Computer Science from University of Cambridge in 1980, with a dissertation which was highly significant in the development of algorithms for symbolic integration. He worked on implementing his algorithms in packages distributed with the REDUCE and ScratchPad computer algebra systems, but his pioneering contributions to the rapidly evolving field of computer algebra did not stop there.

In this context, I would like to cite Professor Stephen M. Watt, Dean of the Faculty of Mathematics from the University of Waterloo, who wrote in his appreciation report: *"Since his seminal doctoral thesis "On the Integration of Algebraic Functions," Professor Davenport has been recognized as a leader in the field of symbolic mathematical computation, also known as computer algebra. As son of a famous British number theorist, from an early age Davenport captured a mature mathematical perspective. He entered Cambridge University on scholarship, and earned the Tripos Prize in Mathematics three years running, followed by the Rouse Ball Prize. A mere six years following his doctorate, Davenport was named Hebron and Medlock*

Professor of Information Technology at the University of Bath. Professor James Davenport has contributed equally to the fundamental algorithms of symbolic computation and to the software systems that have led the way to the current state of the art, including REDUCE, ScratchPad and Axiom."

On the other hand, in his appreciation report, David J. Jeffrey from University of Western Ontario, mentions:

"Professor James Davenport has made many pioneering advances in the theory and in the algorithms of computer algebra and symbolic computation. His Doctoral dissertation was highly significant in the development of algorithms for symbolic integration. He is internationally recognised for his contributions to computation with multivalued functions, and for his masterly analysis of the complexity of Cylindrical Algebraic Decomposition. In addition to his outstanding contributions to research, he has been a leader of international efforts to standardize definitions and to facilitate the interchange of mathematical information, through such initiatives as the OpenMath database, and his work on mathematical knowledge management.

Professor Davenport's most recent initiatives in Satisfiability Checking and Symbolic Computation promise to be true paradigm shifts in what computer science can deliver in the way of solving complex problems. Professor James Davenport has maintained a position of international influence and service for many years, and is a most notable and deserving candidate for the degree of Doctor Honoris Causa."

Professor James Davenport has published seven books, including a monograph on the integration of algebraic functions, and four editions of his father's book *"The Higher Arithmetic."* He is the lead author of the first introductory book in Computer Algebra, published in English and Russian.

His publication output in terms of refereed articles in highly ranked international journals and conference proceedings and in terms of books of which he was an author or co-author is impressive and far beyond average. He has published 143 refereed articles and 56 unrefereed articles, as well as several technical reports. His scientometric profile can also be described in the most eloquent terms, with more than 4000 citations, an i10 index of 90 and an h-index of 29, according to Google Scholar. We can note here, as an example, one of his books, *Computer algebra: systems and algorithms for algebraic computation*, which has accumulated 669 citations.

James Davenport is also a very productive and brilliant teacher and mentor. He has started his teaching career in 1982 at Université Scientifique et Médicale de Grenoble, and is Hebron and Medlock Professor of Information Technology at the School/Department of Mathematical Sciences and Department of Computer Science, University of Bath. He has taught numerous courses on all levels, led the production of five editions of a custom text to support first-year teaching, and has supervised 18 doctorates. His students and research officers made significant scientific contributions, as witnessed by 41 additional papers published under his supervision.

He has held many posts in University Administration: Director of Studies (twice), Head

of School, Chairman of Boards of Studies, and more recently as University Director of Information Technology, a position equivalent to Pro-Vice-Chancellor (I.T.), spear-heading the University's developments in e-learning. He has been heavily involved in University governance through Senate, Council and its Finance and General Purposes and Nominations Committees, the Honorary Degrees Committee and the Committees to appoint Bath's two most recent Vice-Chancellors. He instituted the University's Quality Assurance framework, and took it through its first "Academic Audit". He coordinated the purchase of the University's first High-Performance Computer system in 2007. He ensures the interface between university management, users and computing service, and has led the purchase of the replacement in 2013. He is an experienced assessor for the British Computer Society's Accreditation Panel, and for the Institute of Mathematics and its Applications.

Professor James Davenport has also worked as scientific and technical consultant for various entities: the CAP-CPP group, IBM (Thomas J. Watson Research Centre) and, as a Royal Society Industrial Fellow, for Numerical Algorithms Group (NAG)[1]. He has been on NAG's Technical Policy Committee/Forum since 1989, and chaired their Life Service Awards Committee 2011-2015. He has done several pieces of industrial and government consultancy, and also taught a Continuing Professional Development course for Motorola Inc. His most recent industrial sojourn was at the INRIA/Microsoft Joint Centre, Saclay, in April/May 2011.

Being constantly and actively involved in the adaptation of Computer Science curricula to current advances in technology and to the requirements of the society, Professor Davenport participated recently to a case study-based research concerning the education in cybersecurity which is, as it is stated in a report published in July 2019, *"a first step towards better understanding the nature, design, structure and assessment of cybersecurity education in the UK."* Also this July, Professor Davenport oversaw the IT for the 60th International Mathematical Olympiad held in Bath. These are just some examples illustrating to how many and diverse activities Professor Davenport usually participates.

Professor Davenport is a widely sought expert, having been invited to lecture in more than thirty countries and dozens of international meetings. He has held visiting Professorships in eight French institutions, in Austria, China, Italy, Germany, Sweden, the U.S.A and Canada (twice). He has examined PhD or higher theses in many countries, including Austria (3), France (17), Germany (3), Netherlands and Sweden, as well as in the U.K.

The editorial contribution of Professor James Davenport is equally remarkable. He was

- an associate editor of the *Journal of Symbolic Computation* (1984-2004), the most prestigious journal in the field,
- founding editor-in-chief of the London Mathematical Society's *Journal of Computation and Mathematics*, an all-electronic journal

[1]NAG provides expertise in numerical engineering, by delivering high-quality computational software, consulting services and high performance computing services

and currently is an editor of *Applied Algebra & Error-Correcting Codes* and *Mathematics in Computer Science*. He also edited 16 conference proceedings and compiled books.

The professionalism of James Davenport is also acknowledged by his activities within the *British Computer Society*. He is serving his fourth term on the BCS Council and is Vice-President (Chair of Academy Board). He is on the Society's Board of Trustees and has served on its Engineering & Science Board and Audit & Risk Committee. He has written several policy/press papers for BCS. He was South-West Regional Coordinator of the *Computing At School Network of Excellence* (funded during 2012-2015 by the Department of Education), and currently he runs the Bath Hub of this network. He was also a member of the Outer Circle of the Royal Society funded Advisory Committee on Mathematical Education (essentially as Computer Science's representative), and represents the Institute of Mathematics and its Applications on the London Mathematical Society's Computer Science Committee. He was Director of Studies for the EPSRC-funded Doctoral Taught Course Center in High-Performance Computing.

On the international front, after six years as a member, he is now Chair of the *International Mathematical Union's Committee on Electronic Information and Communication*. He is well-known in European research circles, currently coordinating a European FET[2] Network. He coordinated other five projects in past. As well as much correspondence refereeing, he has been invited to refereeing meetings by the European Union and of research foundations and agencies from several countries as, for instance, United Arab Emirates, Austria, France. He currently represents the European Mathematical Society on the Scientific Advisory Board of the European Digital Mathematical Library.

The energy and strength of our candidate's academic voice have also been acknowledged by an impressive number of research grants. Professor James Davenport has held 52 research grants, with a total value brought to the University of Bath of more than 5.5 millions of pounds. For several of the major grants, notably European ones, he was either a, or the, principal author.

Since 2009, Professor James Harold Davenport has visited the West University of Timişoara, almost in each year, giving invited talks and being very actively involved in the organization of the International Symposium of Symbolic and Numeric Algorithms for Scientific Computing, as program chair in 2016 and co-chair of the Symbolic Computation track since 2017. He offered a constant support to the staff of the Computer Science Department and can be already considered as an honorary member of our academic community.

In his appreciation report, Professor Dorel Lucanu from Alexandru Ioan Cuza University was inspired by James Davenport's paper *"Computer Algebra and the three 'E's: Efficiency, Elegance and Expressiveness"* and describes him as *"A Computer Algebra Scientist with three + one 'E's: Efficiency, Elegance and Expressiveness plus Erudition.*

Efficiency: *the most cited article, "Real quantifier elimination is doubly exponential" is re-*

[2]Future and Emerging Technologies.

lated to the efficiency of the computation. It is shown that quantifier elimination over real closed fields can require doubly exponential space and time.

Elegance: *can be found in everything related to James Davenport, in his style of scientific writing, in his way of speaking and teaching, in the comments of his blog, and including how to dress.*

Expressiveness: *major contribution to the OpenMath project, a standard for representing mathematical objects with their semantics, allowing them to be exchanged between computer programs, stored in databases, or published on the worldwide web. James Davenport is vice-president of the OpenMath Society, whose main goal is to bring together mathematical tool builders, software suppliers, publishers and authors.*

Erudition: *deep and broad familiarity with computer algebra and cryptography-related fields and not only, a huge number of lectures given in institutions spread all over the world."*

We could add a fifth "E" to this description, coming from *Energy*. Professor Davenport possesses an exceptional amount of energy and power of work reflected by the numerous activities in which he is always involved and by the brilliant contributions he made to the scientific fields where he worked.

On the basis of the academic and scientific arguments and the evidence of exceptional professional expertise outlined above, the West University of Timişoara is honoured to award the title of Doctor Honoris Causa Scientiarum to Professor James Harold Davenport, from University of Bath.

I would also like to address to you, distinguished Professor James Davenport, our warmest congratulations and to wish you a long, successful career as researcher and teacher.

COMISIA DE EVALUARE ŞI DE ELABORARE A LAUDATIO

Preşedinte:

- **Prof.univ.dr. Marilen Gabriel PIRTEA**, *Rectorul Universităţii de Vest din Timişoara*

Membri:

- **Prof.univ.dr. Viorel NEGRU**, *Preşedintele Senatului Universităţii de Vest din Timişoara*
- **Prof.univ.dr. Stephen M. WATT**, *Decan al Facultăţii de Matematică şi Informatică, University of Waterloo, Canada*
- **Prof.univ.dr. Daniela ZAHARIE**, *Decan al Facultăţii de Matematică şi Informatică, Universitatea de Vest din Timişoara*
- **Prof.univ.dr. Tudor JEBELEAN**, *Research Institute for Symbolic Computation (RISC-Linz), Austria*
- **Prof.univ.dr. Laura KOVACS**, *Vienna University of Technology, Austria*
- **Prof.univ.dr. David JEFFREY**, *University of Western Ontario, Canada*
- **Prof.univ.dr. Dorel LUCANU**, *Universitatea Alexandru Ioan Cuza*
- **Conf.univ.dr. Mircea MARIN**, *Universitatea de Vest din Timişoara*

Speech of
Professor James Harold Davenport
on the occasion of receiving the title of
Doctor Honoris Causa Scientiarum
of the West University of Timişoara

Domnule Rector,
Domnule Preşedinte al Senatului,
Stimaţi Membri ai Comisiei de Laudatio,
Dragi Colegi şi Onorată Audienţă,

Mulţumesc din suflet pentru onoarea acordată mie de către această prestigioasă Universitate!

Titlul *Honoris Causa* makes me very proud to reflect on my association with Universitatea de Vest din Timişoara. I have known several distinguished alumni of UVT for many years, some of whom have done me the honour of being on this Commission. For the last ten years, I have been coming to, and doing my small bit to help with the running of, these SYNASC conferences, and I want to reflect on this.

To unpack SYNASC, it stands for "Symbolic and Numeric Algorithms for Scientific Computing", or, for those who prefer less technical words, "Algebra and Arithmetic for Scientific Computing". Very roughly speaking, we can say that arithmetic deals with specific known numbers, whereas algebra deals with unknown numbers, or the generality of all possible numbers. Most people, when they think of computers, think of arithmetic: a habit that goes back to General Menabrea, the first person to document Babbage's talks. But Ada, Countess Lovelace [Ada43], corrected him, saying "We may say most aptly that the Analytical Engine weaves algebraical patterns just as the Jacquard loom weaves flowers and leaves". The first theses in computer algebra are, in fact, as old as I am, and I have worked in this field for many years. But algebra and arithmetic are symbiotic, not contradictory, and hence it is extremely good to have a conference which has both aspects, and indeed invited lectures and tutorials that are interdisciplinary, as this year, and many papers which cross the border.

Computing, whether symbolic or numeric, requires precision of statement. This may seem obvious, and mathematicians are notorious for their precision. But a mathematician's precision is often local, e.g. "in a suitably chosen open set", and computer systems have global application. This can lead to problems where different open subsets might give incompatible results, and even paradoxes. Hence computer systems need to be good at reasoning in this domain, and this area, which was a theme when I was working in Paris and was published in SYNASC [CDKS12], is an example where one cannot do the arithmetic without being aware of the algebra.

I am a happy computer science professor. When I flew here, I trusted my life to a University

of Bath spinout company, and to my former students who work there. This company is responsible for the software of the UK's National Air Traffic Services, which traces its origins to the world's first air traffic control regime (founded over Croydon Airport). This system has logged over a million hours without a software fault, which is at least a thousand times better than my laptop. This high-quality software is not a Bath, or a British, monopoly: one example, which I learned about at the Symbolic Computation and Satisfiability Checking workshop held at SYNASC 2016, is Line 14 of the Paris Métro, which by now has operated for twenty years without a software error. One might think that such high-quality software was the product of a great deal of testing. But testing is, like arithmetic, dealing with specific cases. What we need is a demonstration that, in all circumstances, the software will not do the wrong thing, which in turn means a formal definition of "wrong thing" — again the domain of algebra, though in computing this is often called "Formal Methods". In that context, I am particularly pleased that FROM 2019, the Working Formal Methods Symposium 2019, has just been held here in conjunction with SYNASC. One of the major aims of the Symbolic Computation and Satisfiability Checking community [ABB$^+$16] is to expand the scope of "Formal Methods".

These days, SYNASC is more than just "Symbolic and Numeric Algorithms": there is a flourishing Artificial Intelligence track. Artificial Intelligence is much in the news currently. But most commentators are referring to one particular type of AI — Machine Learning: multi-layer neural nets trained on big data to recognize patterns. These so-called "deep learning" algorithms are great at learning more or less the same sort of stimulus/response functionality that our right brain hemispheres carry out. Before it had a name upgrade, Machine Learning was known as Pattern Recognition, and this is still basically what it is doing. But, as Doug Lenat, one of the main players in the other sort of Artificial Intelligence, points out [Len19], there is also the work that our left brain hemispheres do.

We can perhaps best compare the two by looking at two AI projects to do mathematics examinations. Deepmind, the AI-specialist part of the Alphabet Group (owners of Google) were looking at GCSE Mathematics (the examination taken by practically everyone aged 16 in England). A pass at this is a requirement to study practically any subject at practically any university. Deepmind's tool, based on Machine Learning, was an abject failure [New19, SGHK19], getting the worst form of failure, achieved by less than the bottom 10% of English children. Conversely, the Todai Robot project [AMIA14] was studying entrance to Japanese universities in all subjects, though mathematics was its best by far. In Mathematics, the Todai Robot uses Machine Learning to read the exam paper, then Machine Learning with linguistics to understand the text (distinctly non-trivial: see [AMIA14, §3]), then domain-specific reasoners, and then a complex program involving Machine Learning with linguistics to "write" the answer. The most successful domain-specific reasoner, in the sense of the one that solved the most problems in the Tokyo University entrance examination, was Real Algebraic Geometry — precisely the subject of several SYNASC papers, and Erika Ábrahám's invited talk at SYNASC 2017. When I last heard, the Todai Robot couldn't quite get into Tokyo University to study Mathematics, but could get into most other Japanese universities.

While it's hard to do a precise comparison, this means roughly that Todai Robot was in the top 1%, but not the top 0.1%, of Japanese 17 year olds.

Much of the recent publicity around Artificial Intelligence has in fact been about the current kinds of Machine Learning. These are basically the result of large amounts of computation on massive amounts of data, as the underlying algorithms try to find distinguishing features. This is basically arithmetic, though one algebraic technique, automatic differentiation, is being used in places [BPRS18]. As such, while it is possible to say what such a Machine Learning system will do on a given piece of input, essentially a test, it is impossible with the current state of technology to make statements in general, essentially the equivalent of formal methods.

Does this mean I am glad that the company I mentioned doesn't use machine learning? Not at all, for in fact it is used extensively in the process of generating the formal proofs that underpin the safety of their products. Just as a trained mathematician reaches for the right lemmas, without examining every lemma ever learned to decide if it is the right one, machine learning has a great rôle to play in equipping formal methods with a similar activity [KBKU13]. Such an interplay between machine learning and algebra has also been part of the SYNASC programme [HEDP16].

Hence I wish the West University of Timișoara a Happy 75th Birthday, and the SYNASC conference series a Happy 21th Birthday, and in both cases ***Mulţi Ani Fericiţi.***

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CURRICULUM VITAE

James Harold Davenport
Hebron & Medlock Professor of Information Technology
University of Bath
Bath, England; J.H.Davenport@bath.ac.uk

Education

Trinity College, Cambridge (as Entrance Scholar)

1971–1972	Part 1A Mathematics 1st; Tripos Prize
1972–1973	Part 1B Mathematics 1st; Tripos Prize; Senior Scholarship
1973–1974	Part II Mathematics 1st; Tripos Prize
June 1974	B.A. (Honours)
1974–1975	Part III Mathematics Honours [now M.Math.]; Rouse Ball Prize
1976–1979	Computer Laboratory Research Student
Feb. 1978	M.A.
Feb. 1980	Ph.D. (submitted June 1979)
	Thesis: "On the Integration of Algebraic Functions"

Distinctions

Territorial Decoration (1994)
Bronze Medal of the University of Helsinki (2001)
National Teaching Fellowship (2014)
Software Sustainability Institute Fellowship (2016)
Fulbright Cyber Security Scholar 2016–2017
New York University (February–July 2017)

2019 Distinguished European Leadership Award Winner,
International Collegiate Programming Contest
Presented with *Kurt Gödel The album* by Förderung der wissenschaftlichen Forschung:
"You have contributed significantly to the development of scientific research in Austria."

Intellectual Summary

James Davenport[3] has been working in computer algebra in general, and symbolic integration in particular, since 1976. His Ph.D. thesis *on the integration of algebraic functions* (Springer-Verlag and MIR) forms the basis of the `ALGINT` facility of Reduce. He has also worked on the Scratchpad (now known as Axiom) integrator, and on other aspects of Axiom, a computer algebra system incorporating the philosophy of "Modern Algebra", which he helped design. He was an associate editor of the *Journal of Symbolic Computation* and *Applied Algebra and Error-Correcting Codes*, and is an editor of *Mathematics in Computer Science*, and was chosen as founding editor-in-chief of the LMS *Journal of Computation and Mathematics*, an all-electronic journal[4]. He is the lead author of the first introductory text-book in the area — *Computer Algebra* (Masson, Academic Press and MIR). He is a leading member in the OpenMath movement, being the Editor of the Content Dictionaries, and organiser of the 22nd Workshop. He has been appointed to, and chaired until the end of 2018, the International Mathematical Union's Committee on Electronic Information and Communication. He has been elected to the Council of the British Computer Society (2010–), and is now a Vice-President (Chair of Academy Board).

Employment

1970–1973	Atlas Computer Laboratory
(15 months)	Scientific Assistant specialising in Mathematical Software
1975–1976	CAP-CPP Group
	Programmer specialising in software packages and portability, especially on IBM computers.
1979–1980	IBM Thomas J. Watson Research Center.
	Post-Doctoral Fellow in Mathematical Sciences Department
1980–1983	Emmanuel College, Cambridge; Research Fellow
1982–1983	Université Scientifique et Médicale de Grenoble (now Université Joseph Fourier)
	Professeur Associé (Contingent National)
1983	Visiting Researcher, ETH Zürich (one month)
1983	Visiting Researcher, University of Delaware (two months)
1983–1986	Lecturer, School of Mathematics, University of Bath

[3] Son of the famous British number theorist.
[4] `www.lms.ac.uk/jcm`. Reviewed in the *Times Higher Education Supplement* 23.11.2001, p. 28.

1986–	Hebron and Medlock Professor of Information Technology, School of Mathematical Sciences, University of Bath
1996–2005	University Director of Information Technology

Other experience

1984	Visiting Lecturer, University of Cambridge (Part III Mathematics)
1984–1985	Visiting Lecturer, University of Pisa
1985, 1987	Visiting Lecturer, KTH Stockholm
1986	Professeur Associé, École Centrale, Paris
	Professeur Associé, École Polytechnique, Paris
1986	Consutant, Rand Corporation, Santa Monica
1988	Professeur Associé, Université Louis Pasteur, Strasbourg
1988	Gastforscher, GMD, Bonn
1989	Professeur Associé, Université de Nice-Sophia Antipolis
1991	Professeur Associé, Université de Limoges
1993	Visiting Professor, Московский Государственный Университет (Moscow State University)
1995	Professeur Associé, Université de Paris VI
1995–1996	Royal Society Industrial Fellow, NAG Ltd, Oxford (80% FTE)
2000	Ontario Research Chair in Computer Algebra (University of Western Ontario)
2009	(Feb.–Jul.) Visiting (Full) Professor, University of Waterloo (Ontario)
2011	(Apr.) Professeur Invité, INRIA (Rocquencourt/Saclay), France
2016–2017	Director, North West Europe Regional Contest
	ACM International Collegiate Programming Contest
2017	Fulbright CyberSecurity Scholar at New York University

Societies

Institute of Mathematics and its Applications

Associate Fellow (1986–1987)
Fellow #13461 (since 1987)
Chartered Mathematician (since 1991)
Representative on LMS Computer Science Committee (since 2012)
Research Committee Member (since July 2015)

British Computer Society

Fellow (since 2007)
Member #8276129 (1987–2007)

Member of the BCS Academy (since 25 June 2010)
Chartered Information Technology Professional (since 1994)
Council March 2010–May 2012; 2012–2014; *ex officio* 2014–
Member of the Trustee Board (since May 2013)
Vice-President and Academy Trustee (March 2014–March 2017)
Vice-President and Academy Chair (March 2017–March 2020)
EQANIE Accreditation Committee (since October 2017)
Deputy Chair (since October 2017)

London Mathematical Society

Member (since 1994)
Member of Computer Science Committee (since 2012)

British Standards Institution

ART/001 Artificial Intelligence Committee (since March 2019)
ISO/IEC SC42 Ad Hoc Group on Outreach (since June 2019)
WG 3 — Trustworthiness (since July 2019)

ACM Intercollegiate Programming Contest (ICPC)

Coordinator, Bath team (since 2011)
Co-founder UKIEPC subregional of NW Europe Regional (since 2013)
Manager, UKIEPC 2015[5]
Regional Director, NWERC 2016, 2017

Software Sustainability Institute Fellowship (since 2016)

Delegation to Workshop on Software Sustainability (2019)

Society of Industrial and Applied Mathematics (since 2015)

Activity Group on Algebraic Geometry (since 2015)

Worshipful Company of Information Technologists

Freeman (2016)
Freeman of the City of London (16 August 2018)
Liveryman (10 October 2018)

[5]For the first time, UK and Ireland ran their own problem set, and had their own judging system, hosted at Bath. See `http://www.bath.ac.uk/comp-sci/news/bath-runs-national-programming-contest.html`.

OpenMath Society (since 1999)

Content Dictionary Editor (since 2001, renewed 2007)
Programme Chair, OpenMath Workshop 2009 (Grand Bend, Ontario)
Steering Committee member (since 2013)

International Mathematical Union

Committee on Electronic Information and Communication (July 2008–Dec. 2014; Chair Jan 2015–Dec. 2018)
Electronic Archiving Committee (Chair; since February 2009)
EpiSciences EpiCommittee (http://www.episciences.org/epimath.html)
Mathematics MOOCs Panel Moderator, ICM 2014
Machine-Assisted Proof Panel Moderator, ICM 2018

Scientific Advisory Board, EuDML (www.eudml.eu) (since 2011)

Scientific Committee, Science Mobility Station[6] (since 2017)

External lectures:

Austria: 5, Belgium: 3, Britain: 88, Bulgaria: 1, Canada: 18, China5, Denmark: 1, Estonia: 1, Finland: 3, France: 60, Germany: 39, Holland: 11, Hungary: 2, India: 1, Ireland: 2, Italy: 20, Japan: 3, Korea: 2, Luxembourg: 4, Morocco: 1, Poland: 3, Portugal: 2, Romania: 8, Russia: 2, Slovakia: 1, Spain: 8, Sweden: 7, Switzerland: 7, U.S.A.: 33.

External Examining:

England: 9, Scotland: 4, Austria: 3, France: 17, Germany: 3, Italy: 1, Sweden: 1.

Publications

Books etc:

(B.1) On the Integration of Algebraic Functions. Springer Lecture Notes in Computer Science 102, Berlin-Heidelberg-New York, 1981. Russian translation "Integrirovanie Algebraicheskikh Funktsii" (Интегрирование алгебраических функций) MIR Moscow, 1985.

(B.2) The Higher Arithmetic (5th. ed.), by H. Davenport, edited D.J. Lewis & J.H. Davenport. Cambridge University Press, 1982. MR 84a:10001.

[6] `http://cc4cm.org/sms/english/committee.html`.

(B.3) PowerMath: the First Symbolic Manipulation Program for the Macintosh (with Roth C.E.). Brainpower Inc., Ventura, Calif. 1985.

(B.4) Calcul Formel (with Siret Y. and Tournier E.). Masson, Paris, 1986; 2nd. edition 1993 (ISBN 2–225–84200–0). English translation "Computer Algebra" Academic Press, London, 1988 (ISBN 0–12–204230–1). Russian translation "Komp'yuternaya Algebra" (Компьютерная Алгебра) MIR Moscow, 1991 (ISBN 5–03–001658-9). 2nd. English edition Academic Press, 1993 (ISBN 0–12–209232–8)[7].

(B.5) The Higher Arithmetic (6th. ed.), by H. Davenport, edited J.H. Davenport, C.U.P., 1992 (ISBN 0–521–42227–2). Zbl. 751.11001.

(B.6) The Higher Arithmetic (7th. ed.), by H. Davenport, edited J.H. Davenport, C.U.P., 1999 (ISBN 0–521–63446–6).

(B.7) The Higher Arithmetic (8th. ed.), by H. Davenport, edited J.H. Davenport, C.U.P., 2008 (ISBN 978–0–521–72236–0).

Edited in compiled books:

(b.8) Proceedings EUROCAL '87 (editor). Springer Lecture Notes in Computer Science 378, 1989.

(b.9) Mathematical Knowledge Management 2003 (ed. Asperti, A., Buchberger, B. & Davenport, J.H.), Springer Lecture Notes in Computer Science 2594, Springer-Verlag, 2003. ISBN 978–3–540–00568–1.

(b.10) Proceedings of the 22nd OpenMath Workshop (Grand Bend, Ontario, 2009). University of Bath Press and OpenMath Society, 2009. ISBN 978–1–86197–172–2.

(b.11) Programming and Discrete Mathematics (compiled by J.H. Davenport, I.G. Graham and G.K. Sankaran from works by Chapman and Epp), Cengage, 2009.

(b.12) Proceedings CICM 2011 (with W.M. Farmer, F. Rabe & J. Urban), Springer Lecture Notes in Artificial Intelligence 6824, 2011. ISBN 978–3–642–22673–1.

(b.13) Programming and Discrete Mathematics (compiled by J.H. Davenport, I.G. Graham and G.K. Sankaran from works by Chapman and Epp), Cengage, 2012.

(b.14) MathUI, OpenMath, PLMMS and ThEdu Workshops and Work in Progress at the Conference on Intelligent Computer Mathematics 2013 (with C. Lange, D. Aspinall, J. Carette, A. Kohlhase, M. Kohlhase, P. Libbrecht, P. Quaresma, F. Rabe, P. Sojka, I. Whiteside and W. Windsteiger), CEUR Workshop Proceedings, Aachen, 2013. `http://ceur-ws.org/Vol-1010/`.

[7]Reviewed in Computing Reviews 9404-0219.

(b.15) Proceedings CICM 2014 (with S.M. Wattt, A.P. Sexton, P. Sojka & J. Urban), Springer Lecture Notes in Artificial Intelligence 8543, 2014. ISBN 978–3–642–22673–1.

(b.16) CICM-WS-WiP 2014: Workshop and Work in Progress Papers at CICM 2014 (with M. England, A. Kohlhase, M. Kohlhase, P. Libbrecht, W. Neuper, P. Quaresma, A.P. Sexton, P. Sojka,J. Urban, S.M. Watt). `http://ceur-ws.org/Vol-1186/`.

(b.17) Programming and Discrete Mathematics (compiled by J.H. Davenport, G.K. Sankaran & A. Spence, including work by Chapman), Cengage, 2014.

(b.18) Programming and Discrete Mathematics (compiled by J.H. Davenport, G.K. Sankaran & M.A. Freitag, including [different] work by Chapman), Cengage, 2014.

(b.19) Proceedings SYNASC 2015 (with L. Kovács and others), IEEE Computer Press, 2016.

(b.20) Proceedings SCSS 2016 (with F. Ghourabi), EPiC Series in Computing 39, 2016. `http://easychair.org/publications/volume/SCSS_2016`.

(b.21) Proceedings SYNASC 2016 (with L. Kovács and others), IEEE Computer Press, 2017.

(b.22) Proceeedings SC-Square 2016: Satisfiability Checking meets Symbolic Computation (with E. Ábrahám & P. Fontaine). `http://ceur-ws.org/Vol-1804/`.

(b.23) Proceedings ICMS 2018 (with M. Kauers, G. Labahn & J. Urban), Springer Lecture Notes in Computer Science 10931, Springer, Cham, 2018. ISBN 978-3-319-96417-1.

Refereed journals and conferences

(R.1) The Quadratic Hash Method when the table size is a power of 2 (with Hopgood F.R.A.). Computer Journal 15 (1973) pp. 314–5.

(R.2) Numerical Tables on Elliptic Curves (with Swinnerton-Dyer H.P.F., Stephens N.M., Vélu J., Coghlan F.B., Atkin A.O.L. and Tingley D.J.). In: Modular Functions of One Variable IV (Proceedings Antwerp 1972), Springer Lecture Notes in Mathematics 476, Springer-Verlag, Berlin-Heidelberg-New York, 1975. MR **52** (1976) #10557.

(R.3) Symbolic Integration — the Dust Settles? (A survey paper on algorithms for indefinite integration; with Norman A.C). Proc. EUROSAM 79 (Springer Lecture Notes in Computer Science 72) pp. 398–407.

(R.4) The Computerisation of Algebraic Geometry. Proc. EUROSAM 79 (Springer Lecture Notes in Computer Science 72) pp. 119–133.

(R.5) Algorithms for the Integration of Algebraic Functions. Proc. EUROSAM 79 (Springer Lecture Notes in Computer Science 72) pp. 415–425.

(R.6) MODLISP — an Introduction (with Jenks R.D). Proc. LISP80, The LISP Conference, P.O.Box 487, Redwood Estates, California 95044, 1980 (reprinted in SIGSAM Bulletin 15 (1981) 1 pp. 11–20).

(R.7) Effective Mathematics — the Computer Algebra viewpoint. Proc. Constructive Mathematics Conference 1980 (ed. F. Richman) (Springer Lecture Notes in Mathematics 873) pp. 31–43.

(R.8) Factorization over finitely generated fields (with Trager B.M.) Proc. SYMSAC 81 (ACM, New York) pp. 200–205.

(R.9) Table Erratum 587. Math. Comp. 38 (1982) pp. 335–336.

(R.10) On the Parallel Risch Algorithm (I). Proc. EUROCAM '82 (Springer Lecture Notes in Computer Science 144) pp. 144–158. Zbl 538.68024.

(R.11) Integration — where is the Theory going? Proc. EUROCAL 83 (Springer Lecture Notes in Computer Science 162) pp. 2–11.

(R.12) Factorization of Sparse Polynomials. Proc. EUROCAL 83 (Springer Lecture Notes in Computer Science 162) pp. 214–224.

(R.13) Quelques Difficultés de Calcul Formel. "Calcul Formel et Automatique" (ed. P. Chenin), Éditions CNRS, Paris, 1987, pp. 47–66.

(R.14) Calcul modulaire. "Calcul Formel et Automatique" (ed. P. Chenin), Éditions CNRS, Paris, 1987, pp. 67–78.

(R.15) Implémentation VLSI d'algorithmes modulaires issus du Calcul Formel (with Robert Y.). "Calcul Formel et Automatique" (ed. P. Chenin), Éditions CNRS, Paris, 1987, pp. 219–237.

(R.16) Integration — Numerical and Formal approaches. Proc. Languages, Methods and Tools in Scientific and Engineering Computation (ed. B. Ford, J.C. Rault and F. Thomassen), North-Holland), 1984, pp. 417–427. Zbl 547.65010.

(R.17) Intégration des Fonctions Élémentairement Transcendentes sur une courbe algébrique. *Annales de l'Institut Fourier* (Grenoble) **34** (1984) pp. 271–276.

(R.18) Factorization of Medium-sized Integers (with Macmillan R.J.). *Computer Journal* **27** (1984) pp. 83–84.

(R.19) VLSI and Computer Algebra: The GCD Example (with Robert Y.). In "Dynamical System and Cellular Automata", Academic Press, 1985, pp. 359-367.

(R.20) y' + fy = g. Proc. EUROSAM 1984 (Springer Lecture Notes in Computer Science 174) pp. 341–350. Zbl 588.68013.

(R.21) Programming Considerations (with D. Coppersmith). Section XI of Coppersmith, D., Fast Evaluation of Logarithms in Fields of Characteristic Two. *IEEE Trans. Information Theory* IT-30(1984) pp. 587–594.

(R.22) Closed Form Solutions of Ordinary Differential Equations. Proc. RSYMSAC, Wakoshi, Tokyo, Japan (1984) pp. 15–1 — 15–12. A revised version appears in "Symbolic and Algebraic Manipulation by Computers", World Scientific Publ. Co., Singapore, 1985.

(R.23) Symbolic and Numeric Manipulation of Integrals. Proc. IBM Deutschland Conf. "Accurate Scientific Computation" March 1985 (Springer Lecture Notes in Computer Science 235, 1986), pp. 168–180.

(R.24) HEUGCD: How Elementary Upperbounds Generate Cheaper Data (with Padget J.A.). Proc. EUROCAL '85 (Springer Lecture Notes in Computer Science 204) pp. 18–28. Zbl 603.68037.

(R.25) Elementary and Liouvillian Solutions of Linear Differential Equations (with Singer M.F.). Proc. EUROCAL '85 (Springer Lecture Notes in Computer Science 204), pp. 595–596.

(R.26) Mathematics for Problem Solving Environments: Computer Algebra. Proc. IFIP WG 2.5 "Problem Solving Environments for Scientific Computation" (ed. B. Ford & F. Chatelin), North-Holland, 1987, pp. 101–112 (discussion pp. 113–115).

(R.27) The Risch Differential Equation Problem. SIAM J. Computing 15(1986) pp. 903–918.

(R.28) The Parallel Risch Algorithm (II) (with Trager B.M.). ACM Trans. Mathematical Software 11(1985) pp. 356–362.

(R.29) An Application of Factoring (with Coppersmith D.). J. Symbolic Computing 1(1985) pp. 241–243.

(R.30) On Numbers and Polynomials (with Padget J.A.). Proc. "Le Calcul Demain", Masson and Wiley, 1985, pp. 49–53. Zbl 677.68030.

(R.31) Elementary and Liouvillian Solutions of Linear Differential Equations (with Singer M.F.). J. Symbolic Computing 2(1986) pp. 237–260.

(R.32) Computer Algebra : A Formula is worth 10,000 Numbers. Proc. 7th. Int. Conference Analysis and Optimization of Systems, 1986 (Springer Lecture Notes in Control and Information Sciences 83) pp. 455–468.

(R.33) The Design and Implementation of PowerMath (with Roth C.E.). Proc. SYMSAC 86 (ACM, New York) pp. 13–15.

(R.34) The Bath Algebraic Number Package (with Abbott J.A. and Bradford R.J.). Proc. SYMSAC 86 (ACM, New York) pp. 250–253.

(R.35) Real Quantifier Elimination is Doubly Exponential (with Heintz J.). J. Symbolic Comp. **5** (1988) pp. 29–35. Zbl 663.03015.

(R.36) Factorisation of Polynomials: Old Ideas and Recent Results (with Abbott J.A. and Bradford R.J.). Proc. IBM Deutschland Conf. "Trends in Computer Algebra" (Springer Lecture Notes in Computer Science 296, 1988) pp. 92–118.

(R.37) Integration in Closed Form. Computers in Mathematical Research (IMA Conference (NS) **14** (ed. N.M. Stephens & M.P. Thorne), Clarendon Press, Oxford, 1988, pp. 119–134.

(R.38) Computer Algebra Applied to Itself (with Coppersmith D.). J. Symbolic Comp. **6** (1988) pp. 127–132.

(R.39) A remark on a paper by Wang: Another Surprising Property of 42 (with J.A. Abbott). Math. Comp. **51**(1988) pp. 837–839.

(R.40) Algebraic Computations and Structures. Computer Algebra (Lecture Notes in Pure and Applied Mathematics **113**, ed. D.V. Chudnovsky & R.D. Jenks, Marcel Dekkar, New York, 1989) pp. 129–144. Zbl 677.68029.

(R.41) A Geometric Algebra System (with A. Bowyer, P.S. Milne, J.A. Padget and A.F. Wallis). *Geometric Reasoning* (ed. J. Woodwark), Oxford University Press, 1989, pp. 1–28.

(R.42) Effective Tests for Cyclotomic Polynomials. (with R.J. Bradford). Proc. ISSAC 88 (Springer Lecture Notes in Computer Science 358, Springer-Verlag, Berlin-Heidelberg-New York-Tokyo, 1989) pp. 244–251.

(R.43) Robot Motion Planning. *Geometric Reasoning* (ed. J. Woodwark), Oxford University Press, 1989, pp. 43–52.

(R.44) Applications of Computer Algebra in Solid Modelling (with A. Bowyer, P.S. Milne, J.A. Padget and A.F. Wallis). Proc. EUROCAL '87 (Springer Lecture Notes in Computer Science 378, ed. J.H. Davenport, Springer, 1989) pp. 244–245.

(R.45) Polynomial Factorisation: an Exploration of Lenstra's Algorithm (with J.A. Abbott). Proc. EUROCAL '87 (Springer Lecture Notes in Computer Science 378, ed. J.H. Davenport, Springer, 1989) pp. 391–402.

(R.46) Manipulation of Expressions (with H.-C. Fischer). In: *Improving Floating-Point Programming* (ed. P.J.L. Wallis), Wiley, 1990, pp. 149–167.

(R.47) Current Problems in Computer Algebra System Design. Proc. DISCO'90 (Springer Lecture Notes in Computer Science Vol. 429, ed. A. Miola) pp. 1–9.

(R.48) Scratchpad's View of Algebra I: Basic Commutative Algebra (with B.M. Trager). Proc. DISCO '90 (Springer Lecture Notes in Computer Science Vol. 429, ed. A. Miola) pp. 40–54.

(R.49) On Finding the Largest Root of a Polynomial (with M. Mignotte). Modélisation Mathématique et Analyse Numérique 24(1990) pp. 693–696.

(R.50) Symbolic Computation. Software Engineer's Reference Book, Butterworth-Heinemann, 1991, pp. 62–1 – 62–9.

(R.51) Polynomials whose Powers are Sparse (with D. Coppersmith). Acta Arithmetica 58 (1991) pp. 79–87. Zbl 729.11015. MR 92h:12001.

(R.52) Scratchpad's View of Algebra II: A Categorical View of Factorization (with P. Gianni and B.M. Trager). Proc. ISSAC 1991 (ACM, New York) pp. 32–38. `http://portal.acm.org/citation.cfm\penalty\z@?id=120694.\penalty\z@120699`.

(R.53) Computer Algebra Approaches to Enzyme Kinetics (with J.P. Bennett and M.C. Dewar and D.L. Fisher and M. Grinfeld and H. Sauro). Algebraic Computing in Control (ed. G. Jacob & F. Lamnabhi-Lagarrigue), Lecture Notes in Control and Information Sciences 165, Springer-Verlag, 1991, pp. 23–30. Zbl. 785.92014.

(R.54) Primality Testing Revisited. Proc. ISSAC 92 (ed. P.S. Wang). ACM, New York, 1992, pp. 123–129. ISBN 0–89791–489–9. `http://doi.acm.org/10.1145/143242.143290`.

(R.55) Symbolic and Numeric Computation: The Example of IRENA (with M.C. Dewar and M.G. Richardson). Symbolic and Numerical Computation for Artificial Intelligence (ed. Donald,B.R., Kapur,D. & Mundy,J.L.), Academic Press, 1992, pp. 347–362. ISBN 0–12-220535–9.

(R.56) Computers and Number Theory. Chapter VIII of "The Higher Arithmetic", by H. Davenport, edited J.H. Davenport, C.U.P., 1992. Zbl. 751.11001. Italian trans. "Arithmetica Superiore: Un'introduzione alla teoria dei numeri", Zanichelli, Bologna, 1994. ISBN 0–521–42227–2.

(R.57) Voronoi Diagrams of Set-Theoretic Solid Models (with David Lavender, Adrian Bowyer, Andrew Wallis and John Woodwark). IEEE Computer Graphics & Applications 12(1992) 5, pp. 69–77. ISSN 0272–1716.

(R.58) The Rôle of Intelligence in Computer Algebra. Proc. IMA Conf. "Artificial Intelligence in Mathematics" (ed. J.H. Johnson, S. McKee & A. Vella), IMA Conference Series 51, Oxford University Press, 1994, pp. 159–172. ISBN 0–19–853686–0.

(R.59) An overview of Computer Algebra (with Cohen,A.M. & Heck,A.J.P.). Computer Algebra in Industry (ed. A.M. Cohen), Wiley, 1993, pp. 1–52. ISBN 0–471–93829-7.

(R.60) The "Unknown" in Computer Algebra (with C.R. Faure). Programmirovanie (Jan. 1994) pp. 4–10. Programming and Computer Software 20(1994) 1 pp. 1-5. ISSN 0132–3474.

(R.61) Using Computer Algebra to Choose and Apply Numerical Routines (with B.J. Dupée). AXIS 2(1995) 3, pp. 31–41.

(R.62) An Expert System for Numerical Analysis (with B.J. Dupée). Proc. Polymodel 16: Applications of Artificial Intelligence, (Moscardi, A.O., and Smith, P., eds.) pp. 59–74. ISBN 1-873757-07-7.

(R.63) Computer Science and Mathematics. In "Computing Tomorrow: Future research directions in computer science" (ed. I.C. Wand & R. Milner), C.U.P., 1996, pp. 66–87. ISBN 0–521–46085–9.

(R.64) Galois Groups and the Simplification of Polynomials. Programmirovanie 1997 1 pp. 43–58. English translation Program. Comput Software 23(1997) pp. 31–44. MR 98m:12002. ISSN 0132–3474. University of Bath Electronic Technical Report 92–2[8].

(R.65) An Intelligent Interface to Numerical Routines (with B.J. Dupée). Proc. DISCO '96, Springer Lecture Notes in Computer Science 1128 (ed. J. Calmet & J. Limoncelli), pp. 252–262.

(R.66) An Automatic Symbolic-Number Taylor Series ODE Solver (with B.J. Dupée). Computer Algebra in Scientific Computing (Proc. CASC '99). ed. V.G. Ganzha, E.W. Mayr & E.V. Vorozhtsov, Springer, 1999, pp. 37–50. ISBN 3-540-66047-X.

(R.67) An Exact Real Algebraic Arithmetic with Equality Determination (with N. Hur). Proc. ISSAC 2000 (ed. C. Traverso), pp. 169–174. MR 2002c:11171.

(R.68) Abstract Data Types in Computer Algebra. Proc. MFCS 2000 (ed. M. Nielsen, B. Rovan), Springer Lecture Notes in Computer Science 1893, Springer-Verlag, 2000, pp. 21–35. ISBN 3-540-67901-4

(R.69) Fast recognition of alternating and symmetric Galois groups (with G.C. Smith). *Journal of Pure and Applied Algebra* **153** (2000) pp. 17–25. MR 2001j:20113

(R.70) Reasoning about the elementary functions of complex analysis (with R.M. Corless, G. Litt, D.J. Jeffrey & S.M. Watt). Artificial Intelligence and Symbolic Computation (ed. John A. Campbell & Eugenio Roanes-Lozano), Springer Lecture Notes in Artificial Intelligence Vol. 1930, Springer-Verlag 2001, pp. 115–126. ISBN 3-540-42071-1. `http://dx.doi.org/10.1007/3-540-44990-6_9`

[8] `http://www.bath.ac.uk/~ masjhd/Programmirovanie.dvi`

(R.71) A Generic Root Operation for Exact Real Arithmetic (with N. Hur). Computability and Complexity in Analysis (ed. J. Blanck, V. Brattka & P. Hertling), Springer Lecture Notes in Computer Science 2064, Springer-Verlag, 2001, pp. 82–87. ISBN 3-540-42197-1.

(R.72) Reasoning about the elementary functions of complex analysis (with R.J.Bradford, R.M. Corless, D.J. Jeffrey & S.M. Watt). *Annals of Mathematics and Artificial Intelligence* **36** (2002) pp. 303–318.

(R.73) Lattice Attacks on RSA-Encrypted IP and TCP (with P.A. Crouch[9]). Proc. 8th. IMA Conf. Cryptography and Coding (ed. B. Honary), Springer Lecture Notes in Computer Science 2260, Springer-Verlag, 2001, pp. 329–338. ISBN 3-540-43026-1.

(R.74) Mathematical Knowledge Representation. `http://www.risc.uni-linz.ac.at/conferences/MKM2001/Proceedings`.

(R.75) Table Errata — Abramowitz & Stegun. Math. Comp. **71** (2002) p. 1801.

(R.76) Towards Better Simplification of Elementary Functions (with R.J. Bradford). Proc. ISSAC 2002 (ed. T. Mora), ACM Press, New York, 2002, pp. 15–22. ISBN 1-58113-484-3.

(R.77) The Geometry of $\mathbf{C}^n$ is Important for the Algebra of Elementary Functions. Algebra, Geometry and Software Systems (ed. M. Joswig & N. Takayama), Springer, 2003, pp. 207-224. ISBN 3-540-00256-1.

(R.78) Equality in Computer Algebra and Beyond. *J. Symbolic Comp.* **34** (2002) pp. 259–270.

(R.79) MKM: from book to computer. Proc. Mathematical Knowledge Management 2003 (ed A. Asperi, B. Buchberger & J.H. Davenport), Springer Lecture Notes in Computer Science 2594, Springer-Verlag, 2003, pp. 17–29.

(R.80) Better Simplification of Elementary Functions Through Power Series (with J.C. Beaumont & R.J. Bradford). Proc. ISSAC 2003 (ed. J.R. Sendra), ACM Press, 2003, pp. 30–36.

(R.81) The geometry of $\mathbf{C}^n$ is important for the algebra of elementary functions. Algebra, geometry, and software systems, Springer, Berlin, 2003, pp. 207–224. MR 2005i:33028 (summary).

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(U.46) Travelling through Facebook; Exploring Affordances through the Lens of Age (with N. Panteli, B. Marder and F. Nemetz). Proc. ECIS 2014, the 22nd European Conference on Information Systems. http://aisel.aisnet.org/ecis2014/proceedings/track03/1/.

(U.47) Innovative pedagogical practices in the craft of Computing (wth T. Crick and A. Hayes). HEA Report.

(U.48) SC^2: Satisfiability Checking meets Symbolic Computation (with E. Ábrahám *et al.*). ACM Communications in Computer Algebra 50(2017) pp. 145–147. DOI: 10.1145/3055282.3055285.

(U.49) OpenMath Standard 2.0 Revision 1 (with P.D.F. Ion). https://openmath.github.io/standardom20-2017-07-22/omstd20.pdf.

(U.50) The Debate about "Algorithms". *Mathematics Now* 2017, p. 162. http://opus.bath.ac.uk/56192/.

(U.51) Benchmarking Solvers, SAT-style (with M.N. Brain and A. Griggio). SC-Square 2017 Satisfiability Checking and Symbolic Computation CEUR Workshop 1974, 2017. http://ceur-ws.org/Vol-1974/RP3.pdf.

(U.52) Speaking another language: Agreeing and enforcing principles for global data governance. http://blogs.bath.ac.uk/iprblog/2018/02/06/speaking-another-language-the-challenge-of-agreeing-and-enforcing-principles-for-global-data-governance/.

(U.53) OpenMath and SMT-LIB (with England,M., Sebastiani,R. & Trentin,P.). http://arxiv.org/abs/1803.01592.

(U.54) Regular cylindrical algebraic decomposition (with Locatelli,A.F. & Sankaran,G.K.). https://arxiv.org/abs/1803.04029.

(U.55) Quantifier Elimination for Reasoning in Economics (with Casey B. Mulligan, Russell Bradford, Matthew England, and Zak Tonks). https://arxiv.org/abs/1804.10037.

(U.56) Using Machine Learning to Improve Cylindrical Algebraic Decomposition (with Zongyan Huang, Matthew England, David Wilson & Lawrence C. Paulson). https://arxiv.org/abs/1804.10520.

(U.57) The Institute of Coding: A University-Industry Collaboration to Address the UK Digital Skills Crisis (with R. Hourizi). Proc. SIGCSE '19, ACM, p. 1267. https://dl.acm.org/citation.cfm?doid=3287324.3293834.

Also Bath Computer Science Technical Reports 87-02 (with J.A. Abbott and R.J. Bradford), 87-04 (with G.C. Smith), 87-06, 88-12 (with J.P. Bennett & H.M. Sauro: http://staff.bath/masjhd/WithJPB.pdf), 89-25 (with B.M. Trager), 90-31 (with B.M. Trager), 92-51 (with B.M. Trager & P. Gianni), 91-52, 92-53, 92-67 (with J.A. Abbott and R.J. Bradford) and 96–2; IMAG (Grenoble) Research Reports 357, 358 (with Y. Robert) and 375; University of Delaware Computer and Information Sciences Research Report 83–4; Kungliga Tekniska Högskolan (Stockholm) Numerisk Analys och Datalogi Report TRITA–NA–8511[13]; IBM Research Report RC 14897 (with B.M. Trager), 14859 (with D. Coppersmith); A New Algebra System (now at http://portal.axiom-developer.org/refs/articles/); Axiom Technical Reports ATR/1 (with B.M. Trager), ATR/2 (with B.M. Trager & P. Gianni), ATR/3 and ATR/4; Dagstuhl Seminar Reports 27 (with B. Buchberger and F. Schwarz) and 43 (with F. Krückeberg, R.E. Moore & S.M. Rump), Rapport interne LITP[14] 96/11 (du 5-03-96); OpenMath Project Deliverables 1.2.7 (with S. Buswell, D.P. Carlisle, M.C. Dewar, N. Hur & W.A.Naylor), 1.3.4b, 1.4.5, 1.4.6 (with R.M. Corless, D.J. Jeffrey & S.M. Watt), 1.4.7 (with W.A. Naylor) and 1.4.8; OpenMath Thematic Network Deliverable D02 (with S. Buswell, D.P. Carlisle & M.C. Dewar) "OpenMath — guidelines for tool developers" http://www.openmath.org/projects/ hematic/tools-2.pdf; MONET Project Deliverable D7; MKM Thematic Network Deliverable D1.1.

Published Presentations:

(P.1) Non-linear Real Arithmetic Benchmarks derived from Automated Reasoning in Economics. Casey Mulligan, Russell Bradford, James H. Davenport, Matthew England and Zak Tonks. https://easychair.org/smart-slide/slide/Ns8p.

[13]Reprinted as Bath Report 88-10: http://staff.bath.ac.uk/masjhd/TRITA.pdf. This paper introduced what is now known as the Davenport–Mahler–Mignotte bound. Google Scholar reports 91 citations.

[14]Laboratoire d'Informatique Théorique de Paris (VI).

Contributions to Wikipedia articles on: Monte Carlo methods (added the discrete case); Cambridge academic dress; Bologna Declaration; IP Fragmentation; Jinn (fixed etymology); IBM 3081 (fixed references); International Mathematical Union; Computer Laboratory, University of Cambridge; Moore's Law; Sandybridge (added TLB associativity); Bolyai (added Timişoara street name); CPU cache (added reference to separate vs unified); Auguste Comte (bibliography); Bustard; Birthday Paradox; Jean-Marie Laborde (French); Legal English; Time complexity (Double Exponential Time); Choudhry Rahmat Ali & Edward Welbourne; Quantifier (logic); British standard ordnance weights and measurements, Polynomial greatest common dividors, MANIAC; Wiktionary *quot homines, tot sententiæ*.

Book reviews: 34

Professional Activities

198–1	Reviewer for Computing Reviews. Reviewer of the Month October 2014 (`http://www.computingreviews.com/blog`) Nominated for Best Review 2016 (`http://www.computingreviews.com/recommend/bestof/bestreviews.cfm?bestYear=2016`)
1979–1985	Reviewer for Zentralblatt für Mathematik Program Committee Member for EUROCAM 1982
1983–2000	Reviewer for Mathematical Reviews Member, Comité de Direction du GRECO "Calcul Formel", CNRS France, (1984–1986) Président, Comite Scientifique du GRECO "Calcul Formel", CNRS France, (1987–1990) Associate Editor, Journal of Symbolic Computation 1984–2004 Member, Comité de Direction du GDR "Mathématiques et Informatique", CNRS France, (1991–1994) Committee of Management, European Mathematical Trust (9.3.91–31.5.2000) Editor-in-Chief, LMS Journal of Computation and Mathematics
1983–	70 Programme/Organising Committees

Research Grants

(G.1) SERC Grant from Mathematics Committee of $57,580 for "Computer-based integration in closed form — a rigorous approach".

(G.2) SERC Grant from ACME Directorate of about $185,000 for "Computer Algebra and Solid Modelling" (with A. Bowyer, J.A. Padget and A.F. Wallis).

(G.3) ESPRIT Grant (Bath share about $60,000) "Project DIAMOND" (with P.J.L. Wallis). Project DIAMOND is a joint project of Siemens, University of Karlsruhe, CWI (Amsterdam), NAG (Oxford) and Bath.

(G.4) Bath University Research Fund Studentship

(G.5) SERC Grant from Mathematics Committee of $6,600 for "Algebraic Algorithms Using SCRATCHPAD–II".

(G.6) SERC Grant from Mathematics Committee of $38,890 for "Integration in Closed Form: Further Developments".

(G.7) SERC (Computational Science Initiative) Grant for $93,450 for "Enzyme Analysis Using Computer Algebra" (with J.P. Bennett and H. Kacser (Edinburgh))

(G.8) SERC Grant for $181,386 for "Computational Problems in the Mathematical Sciences" (with R. Sibson and twelve others)

(G.9) SERC Grant from ACME Directorate of about $25,000 for "Computer Algebra and Solid Modelling: further developments" (with A. Bowyer and A.F. Wallis).

(G.10) SERC Grant from Parallel and Novel Architectures Initiative of $84,746 for "Data-Parallel Symbolic and Numeric Computations" (with I.G. Graham, J.A. Padget and A. Spence).

(G.11) British Council/France grant for collaboration with Nice (Prof. Galligo) for 15000FF.

(G.12) COMETT grant of 1400 ECU in support of Bath School in Computer Algebra.

(G.13) SERC Grant from Computational Science Initiative of £53,308 for "Computational Algebra through Scratchpad II and other Software" (with G.C. Smith).

(G.14) Teaching Company Scheme (£171,363) and Nag Ltd (£75,585) grant to promote co-operation: total £246,948.

(G.15) Esprit Basic Research Action grant "POSSO" (**Po**lynomial **S**ystem **So**lving) with Pisa (lead site), Genoa, Paris, Nice, Santander, RISC-Linz, Stockholm, Hagen for 920 KECU. Provisional Bath share 195 KECU (with J.A. Abbott, R.J. Bradford, J.P. ffitch, D.S. Richardson).

(G.16) Royal Society Travel Grant £450 for attendance at ISSAC'92.

(G.17) SERC Grant for "Computational Problems in the Mathematical Sciences" (with Prof. C. Jennison, Prof. A. Spence and ten others) for £80035. GR/J/34156.

(G.18) European Mathematical Trust grants of £191.16, £417.64, *$1,920* and ECU 12,000.

(G.19) Московский Государственный Университет (Moscow State University) travel grant of 4,000 Roubles.

(G.20) London Mathematical Society travel grant of £39.30.

(G.21) JISC New Technologies Initiative Grants of £80665 (subject to continuation of funding; with M.C. Dewar) "More Intelligent Delivery of Numerical Analysis to a Wider Audience".

(G.22) CEC "Human Capital and Mobility" for "Editing and Computing" (with Mika Seppälä (University of Helsinki, co-ordinator), Gaston Gonnet (ETH Zürich), Helmut Lenzing (University of Paderborn), Computer Algebra Netherlands, Flemming Topsoe (University of Copenhagen), Richard Timoney (Trinity College, Dublin) and Heikki Apiola (University of Helsinki)). Bath share 16,000 ECU.

(G.23) CEC "Human Capital and Mobility" for "Symbolic Computation" (with Arjeh Cohen (RIACA, Amsterdam, co-ordinator), Gaston Gonnet (ETH Zürich) and others. Bath share, 25,000 ECU.

(G.24) INTAS grant for cooperative action with former Soviet Union of 75000 ECU (with G. Jacob (Lille) and seven other partners). Bath share 1900 ECU.

(G.25) National Science Foundation/Mathematical Sciences Research Institute (Berkeley) grant for $350 to attend workshop on "Future of Mathematical Communication".

(G.26) Centro Stephano Franscini (ETH Zürich) Travel Grant for SFr. 440 to give the initial survey at their Workshop on Symbolic Rewriting, May 1995.

(G.27) Royal Society Industry Fellowship for 1 year at 80% FTE, from 1.10.95. Held at NAG Ltd (Oxford).

(G.28) Isaac Newton Institute, £570 for "Computer Security, Cryptology and Coding Theory".

(G.29) JISC grant JTAP–5/11 of £95772 for "Composite Computing Methods Integrating Symbolic, Numeric and Graphical Packages for Research Engineers".

(G.30) Acciones Integradas (British Council — Spanish Ministry of Education and Culture) for "Application of Composite Computing Methods": Bath share £2600 (with B.J. Dupée).

(G.31) OpenMath — Accessing and Using Mathematical Information Electronically. ESPRIT IV[15] for 1,700,000 ECUs (Bath share 162,500). With NAG Ltd. (co-ordinator), INRIA, Springer, RIACA (University of Eindhoven), OVe SA, St. Andrews, Stilo Ltd. and Trinity College Dublin.

[15]Davenport wrote the initial proposal, and has been appointed Project Chair.

(G.32) Mathematical Sciences Research Institute[16][17] travel grant of $892.62.

(G.33) EPSRC Grant "NETCA" with J.R.Shackell (University of Kent, co-ordinator), U.H. Martin (University of St Andrews), M.A.H. MacCallum (QMW) and M.C. Dewar (NAG). Total £63217.

(G.34) OpenMath Thematic Network (started 1 July 2001). ESPRIT V network grant[18]. With NAG Ltd. (co-ordinator), RIACA (University of Eindhoven), RISC (University of Linz), University of Saarbrücken, University of St. Andrews, University of Nice–Sophia Antipolis, Stilo Ltd., Springer–Verlag, Explo-IT Ltd. (Theme) and Konrad-Zuse Zentrum für Informatik (Berlin). Bath share 46,499 euros.

(G.35) Mathematics on the NET — MONET. ESPRIT V grant for 130,000 euros[19]. With NAG Ltd. (co-ordinator), University of Manchester, RIACA (University of Eindhoven), RISC (University of Linz), University of Nice–Sophia Antipolis, Stilo Ltd., ESSI and INRIA Sophia Antipolis.

(G.36) "Real Analytic and Algebraic Geometry (RAAG)" (with D.S. Richardson & N.N. Vorobjov) EU Training Network. Bath/U.K. share £72,102.

(G.37) "Accurate Simplification of Elementary Functions" (with R.J. Bradford). EPSRC MathFIT grant for £185495.

(G.38) "Mathematical Knowledge Management (MKMNet)" ESPRIT V Thematic Network for 308,870 euros[20], Bath share 54,670. With NAG Ltd., Heriot-Watt University, University of Birmingham, University College London, Université Pierre et Marie Curie (Paris VI), CWI Amsterdam, Universität des Saarlandes, DFKI, Universität Koblenz–Landau, RISC (Johannes Kepler Universität Linz), Software Competency Centre Hagenberg, Università di Bologna, Uniwersitet Białystok.

(G.39) London Mathematical Society "collaboration with computer science" grant for £500, jointly with C.J. Sangwin (Birmingham) — the "mathematician".

(G.40) Royal Society Travel Grant £1267 for attendance at CICM 2009.

(G.41) Higher Education Academy (Information and Computer Sciences) grant for £3477 "Using Electronic Voting Systems with ResponseWare to Improve Student Learning and Enhance the Student Learning Experience" with M. De Vos (PI), E.H. Cliffe, A. Hayes and N.R. Parmar.

[16] Based on National Science Foundation and International Mathematical Union Funds.
[17] University of California at Berkeley.
[18] Davenport co-wrote the initial proposal, and has been appointed Project Chair.
[19] Davenport co-wrote the initial proposal, and has been appointed Project Chair.
[20] Davenport wrote the initial proposal, and is the technical coordinator.

(G.41) "HPC Short Courses — a coordinated response for training the UK's next generation of HPC users" with P.M. Rodger (Warwick), NAG Ltd., STFC, and many others — EPSRC 2.12.2010 £296,000 (Bath share £8,240).

(G.43) "Real Geometry and Connectedness via Triangular Decomposition" (with R.J. Bradford, in collaboration with Maplesoft Inc. — Canada). EPSRC funding £356630.

(G.44) "Metaphors of Identity" (with N. Pantelli). EPSRC Delivery funding £5000.

(G.45) " Ensuring the Impact of Cutting Edge Computer Algebra": EPSRC Impact Acceleration Account £5000.

(G.46) "Collaboration with TU München": Bath International Research Funding Scheme. £3000.

(G.47) GW4 Coding (JHD PI, with Andrew Calway (Bristol), Pete Burnap (Cardiff) and Richard Everson (Exeter). GW4 Initiator grant for £13,541.

(G.48) "SC-square — Satisfiability Checking and Symbolic Computation: uniting two communities to solve real problems" (JHD PI, with RWTH Aachen, Fondazione Bruno Kessler, Universita degli Studi di Genova, Maplesoft Europe Ltd, Université de Lorraine, Coventry University, University of Oxford, Universität Kassel, Max Planck Gesellschaft, Universität Linz 499,603.75 euros (Bath share 106,956.25).

(G.49) "The creation of localized current and future weather for the built environment" (David Coley, Bath Architecture & Civil Engineering PI, 2 other Bath, and Exeter and Newcastle universities): Bath CS share £14,000.

(G.50) GW4 ARM Computer, £3000000 (with Universities of Bristol, Cardiff and Exeter, and the Met Office): Bath share $\frac{1}{5}$.

(G.51) GW4 Software-intensive Research (with Simon Macintosh-Smith, Dave Acreman & Peter Knowles), GW4 Accelerator Grant for £10,00.

(G.52) Institute of Coding (with R. Hourizi (Bath), 17 other universities and much industry). HEFCE grant for £20M + industry matching funding.
`https://instituteofcoding.org/`. Bath share $\sim \frac{1}{16}$.

(G.53) Zero Peak Building Energy Design for India (with S. Najaratan Bath Architecture & Civil Engineering PI & others), Bath CS Value £23,445.

Current research students

Name	University	Degree	Date	Thesis Title
Jessica Jones[a]	Bath (staff/PT)	Ph.D.	examined	Auto-tuning compiler options for HPC
Ben Pring[b]	Bath	Ph.D.	examined	Cryptography against an adversary with quantum resources
Akshar Nair[c]	Ph.D.	2017		
Zak Tonks[d]	Bath	Ph.D.	2017	
Jack Saunders	Bath	MRes/PhD	2019	

[a] Joint with J.P. Fitch until September 2016, then G.A. McCusker.
[b] Joint with A. Guglielmi.
[c] Joint with G.K. Sankaran (Mathematical Sciences).
[d] Joint with J. Gerhardt (MapleSoft).

Completed research students

Name	University	Degree	Date	Thesis Title
H. Najid-Zejli[a]	Grenoble I	$3^{\text{ème}}$ cycle	1984	Extensions algébriques: cas général et cas des radicaux.
	Doctorat de Troisième Cycle awarded June 1984.			
J.A. Abbott	Bath	Ph.D.	1988	Factorisation over Algebraic Extensions
	Ph.D. awarded Jun. 1989.			
R.J. Bradford	Bath	Ph.D.	1988	Integral Bases and Defects of Integrity
	Ph.D. awarded Dec. 1988.			
P.S. Milne	Bath	Ph.D.	1990	On the algorithms and Implementation of a Geometric Algebra System
	Ph.D. awarded Jun. 1990.			
M.C. Dewar	Bath	Ph.D.	1991	Interfacing Algebraic and Numeric Computation
	Ph.D. awarded Dec. 1991.			
I.W.J. Sparry	Bath	Ph.D.	(lapsed)	
O.M. Tabachnikova	Bath	Ph.D.	1995	Fresh Orderings of Groups
	Ph.D. awarded Dec. 1995			

[a] Joint with J. Della Dora.

Name	University	Degree	Date	Thesis Title
M.G. Richardson	Bath (part time)	Ph.D.	1996	User Interfaces for Numeric Computation
	Ph.D. awarded Jun. 1997			
G.D. Nolan[a]	Bath (staff)	M.Phil. (lapsed)		
N. Doye	Bath	Ph.D.	1997	Abstract Data Types, Universal Algebra and Natural Mappings
	PhD. awarded Jul. 1998			
B. Dupée[a]	Bath (staff)	Ph.D.	1998	More Intelligent Delivery of Numerical Analysis to a Wider Audience
	PhD. awarded Jul. 1998			
S.J. Atkins	Bath CASE	M.Phil.	1997	
N.A. Howgrave-Graham	Bath CASE	Ph.D.	1999	Topics in Cryptography
	PhD. awarded Dec. 1999			
W.A. Naylor	Bath CASE	Ph.D.	2000	Polynomial GCD Using Straight Line Program Representation
	Ph.D. awarded Dec. 2001			
N. Hur	Bath	Ph.D.	2001	A Symbolic and Numeric Approach to Real Number Computation
	Ph.D. awarded Dec. 2001			
A.J. Holt	Bath	Ph.D.	2004	On Computing Discrete Logarithms: Large Prime(s) Variants
	Ph.D. awarded Dec. 2004			
E.H. Jones	Bath	Ph.D.	2006	Reflections on the Number Field Sieve
	Ph.D. awarded Dec. 2006			
Nalina Phisanbut[b]	Bath	Ph.D.	2011	Practical Simplification of Elementary Functions using Cylindrical Algebraic Decomposition
	Ph.D. awarded Dec. 2011			

[a] Joint with M.C. Dewar until 1995.

[b] Joint with R.J. Bradford.

Name	University	Degree	Date	Thesis Title
Saif Al-Kuwari[a]	Bath	Ph.D.	2012	Integrated-Key Cryptographic Hash Functions
	Ph.D. awarded July 2012			
David Wilsoni[a]	Bath	Ph.D.	2014	Cylindrical Algebraic Decomposition
	Ph.D. awarded October 2014			
Acyr Locatelli[b]	Bath	Ph.D.	2015	Cylindrical Algebraic Decomposition
	Ph.D. awarded December 2015			
Ali El Kaafarani[a]	Bath	Ph.D.	2015	Modular Cryptography: Attribute Based Signatures as an Example
	Ph.D. awarded April 2015			
Ieuan Evans[c]	Bath	Ph.D.	2017	Semi-Supervised Topic Models Applied to Mathematical Document Classification
	Ph.D. awarded December 2016			

[a] Joint with R.J. Bradford.
[b] Joint with G.K. Sankaran (Mathematical Sciences).
[c] Joint with P.M. Hall.

Their papers (other than joint with J. H. Davenport

(S.1) Abbott, J.A., Integration: Solving the Risch differential equation. Proc. EUROCAL 87 (Springer Lecture Notes in Computer Science 378, Springer-Verlag, Berlin-Heidelberg-etc., 1989), pp. 465–467.

(S.2) Abbott, J.A., Recovery of Algebraic Numbers from their p-adic Approximations. Proc. ISSAC '89 (ed. G.H. Gonnet), ACM, New York, 1989, pp. 112–120.

(S.3) Abbott, J.A., Some Ideas about Fault-tolerant Chinese Remaindering. Proceedings AAECC 8 (Springer Lecture Notes in Computer Science 508) pp. 155-163.

(S.4) Bradford, R.J., Hermite normal forms for integer matrices. Proc. EUROCAL 87 (Springer Lecture Notes in Computer Science 378, Springer-Verlag, Berlin-Heidelberg-etc., 1989), pp. 315–316.

(S.5) Bradford, R.J., Hearn, A.C., Padget, J.A. & Schrufer, E., Enlarging the REDUCE Domain of Computation. Proc. SYMSAC 86 (ACM, New York, 1986) pp. 100–106.

(S.6) Najid-Zejli, H., Computation in Radical Extensions. Proc. EUROSAM 84 (Springer Lecture Notes in Computer Science 174, Springer-Verlag, Berlin-Heidelberg-New York-Tokyo, 1984) pp. 115–122.

(S.7) Najid-Zejli, H., Calcul dans les extensions de corps. CALSYF 3 (1982/3) pp. 181–197.

(S.8) Dewar, M.C., IRENA — An Integrated Symbolic and Numeric Computation Environment. Proc. ISSAC '89 (ACM, New York, 1989) pp. 171–179.

(S.9) Dewar, M.C., Manipulating Fortran Code in AXIOM and the AXIOM-NAG Link. Proceedings of the Workshop on Symbolic and Numeric Computation (Helsinki, 1993) Research Report B10, Rolf Nevanlinna Institute, Helsinki 1994, pp. 1–12. ISBN 952–9528–27–2.

(S.10) Dewar, M.C., Symbolic Numeric Interfaces. In Computer Algebra in Science and Engineering (Fleischer, J., Grabmeier, J., Hehl, F.W. & Küchlin, W., ed.) World Scientific, 1995, pp. 16–23. ISBN 981–02–2319–6

(S.11) Dewar, M.C. & Richardson, M.G., Reconciling Symbolic and Numeric Computation in a Practical Setting. Proc. DISCO '90 (Springer Lecture Notes in Computer Science Vol. 429, ed. A. Miola) 195–204.

(S.12) Broughan, K.A., Dewar, M.C., Keady, G., Robb, T. & Richardson, M.G., Some symbolic computing links to the NAG numeric library. SIGSAM Bulletin, July 1991.

(S.13) Milne, P.S., On the Solutions of a Set of Polynomial Equations. Symbolic and Numerical Computation for Artificial Intelligence (ed. Donald, B.R., Kapur, D. & Mundy, J.L.), Academic Press, 1992, pp. 89–101. ISBN 0–12-220535–9.[21]

(S.14) Dewar, M.C., Using Computer Algebra to Select Numerical Algorithms. Proc. ISSAC 1992 (ed P.S. Wang) pp. 1–8.. ISBN 0–89791–489–9.

(S.15) Dewar, M.C., Integrating symbolic and numeric computation. Computer Algebra in Industry (ed. A.M. Cohen), Wiley, 1993, pp. 221–232. ISBN 0–471–93829-7.

(S.16) Richardson, M.G., The IRENA User Interface to the NAG Fortran Library. Computer Algebra in Industry (ed. A.M. Cohen), Wiley, 1993, pp. 233–243. ISBN 0–471–93829-7.

(S.17) Dewar, M.C., Schnittstellen und Standardisierung. In Computeralgebra in Deutschland: Bestandsaufnahme, Möglichkeiten, Perspektiven, ed. V. Weispfenning & J. Grabmeier, Fachgruppe Computeralgebra der GI, DMV, GAMM, Passau, 1993, pp. 94–99.

(S.18) Keady, G. & Richardson, M.G., An application of IRENA to systems of nonlinear equations arising in equilibrium flows in networks. Proc. ISSAC 1993 (ed. M. Bronstein, ACM, 1993) pp. 311–320. ISBN 0–89791–604–2.

(S.19) Keady, G. & Nolan, G., Production of Argument SubPrograns in the AXIOM-NAG Link: examples involving non-linear systems. Proceedings of the Workshop on Symbolic and Numeric Computation (Helsinki, 1993) Research Report B10, Rolf Nevanlinna Institute, Helsinki 1994, pp. 13–31. ISBN 952–9528–27–2.

[21] This introduced the "Milne volume function", and, as of February 2019, had 55 citations in Google Scholar.

(S.20) Dupée, B.J., Object Oriented Methods using Fortran 90. Fortran Forum **13** (1994) 1, pp. 21–30. ISSN 0735–3731.

(S.21) Meikle, I.D. & Naylor, W.A., A Physical Application of Computer Algebra. Proc. "Application of Advanced IT", Edinburgh, 1994.

(S.22) Dupée, B.J., Measuring the Likely Effectiveness of Strategies. Proc. Artificial Intelligence and Symbolic Computation 3, Springer Lecture Notes in Computer Science 1138 (ed. J. Calmet, J.A. Campbell & J. Pfalzgraf), pp. 191–196.

(S.23) Howgrave-Graham, N.A., Finding Small Roots of Univariate Modular Equations Revisited. Cryptography and Coding (Ed. M. Darnell), Springer Lecture Notes in Computer Science 1355, 1997, pp. 131–142.

(S.24) Dupée, B.J., Using a Computer Algebra System to Provide a Better Interface to Numerical Routines. Proc. 6th. Rhine Workshop on Computer Algebra (ed. J. Calmet), Sankt Augustin, 1998.

(S.25) Howgrave-Graham, N.A. & Smart, N.P., Lattice attacks on digital signature schemes. HP Labs Technical Report HPL-1999-90.

(S.26) Boneh, D., Durfee, G. & Howgrave-Graham, N.A., Factoring $N = p^r q$ for large r. Proc. Crypto 1999 (Springer Lecture Notes in Computer Science 1666) Springer-Verlag, 1999, pp. 326–337.

(S.27) Howgrave-Graham, N.A. & Siefert,J.-P., Extending Wiener's attack in the presence of many decrypting exponents. Proc. Secure Networking — CQRE '99 (Springer Lecture Notes in Computer Science 1740) Springer-Verlag, 1999, pp. 153–164.

(S.28) Galway, W.F., Dissecting a sieve to cut its need for space. Algorithmic number theory (Leiden, 2000) Lecture Notes in Comput. Sci., vol. 1838, Springer, Berlin, 2000, pp. 297–312. MR 1850613, `https://doi.org/10.1007/10722028_17`.

(S.29) Alvarez Sobreviela, L.[22], A Reduce-based OpenMath ↔ MathML Translator. *ACM SIGSAM Bulletin* special issue on OpenMath **34** (2000) 2, pp. 31–32.

(S.30) Howgrave-Graham, N.A. & Smart, N.P., Lattice attacks on digital signature schemes. Designs, Codes and Cryptography **23** (2001) pp. 283–290.

(S.31) Granger, R., Holt, A.J., Page, D., Smart, N.P. & Vercauteren, F., Function Field Sieve in Characteristic Three. Proc. ANTS-VI (ed. D. Buell), Springer Lecture Notes in Computer Science 3076, 2004, pp. 223–234.

[22]Work coming out of his final year project under JHD.

(S.32) Aird, M.-L.[23], Barbera Medina, W.[23] & Padget, J.A, MONET: service discovery and composition for mathematical problems. Proc. CCGrid 2003, IEEE Press, 2003, pp. 678-685.

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[23]Research Officer.

Position Papers Drafted

(P.1) International Mathematical Union position for International Council for Science (ICSU) on "Open access and evaluation by metrics", August 2013.

(P.2) British Computer Society Evidence on *Online Safety* to House of Commons Select Committee on Culture, Media & Sport, September 2013.

(P.3) British Computer Society Press Release on Facebook Privacy Change: `http://www.bcs.org/content/conWebDoc/51519`: 18 October 2013.

(P.4) British Computer Society Response to ITU/UNICEF "Guidelines for Industry on Child Online Protection" 29 November 2013. `http://policy.bcs.org/consultations/-guidelines-industry-child-online-protection`.

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(P.6) How EU data protection law could interfere with targeted ads. `https://theconversation.com/how-eu-data-protection-law-could-interfere-with-targeted-ads-43651`, 23 June 2015.

(P.7) Institute of Mathematics and its Applications Evidence on *Algorithms in decision-making* to House of Commons Select Committee on Science and Technology, April 2017, See `http://www.parliament.uk/business/committees/committees-a-z/commons-select/science-and-technology-committee/inquiries/parliament-2015/publications/`.

(P.8) British Computer Society Evidence on *Algorithms in decision-making* to House of Commons Select Committee on Science and Technology, April 2017. As above.

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(P.10) British Computer Society Evidence to House of Lords Select Committee on Artificial Intelligence, September 2017. As above.

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Higher Education Academy Workshops Organised

2013: "Experiences of Learning Programming within a Mathematics Course" — James H. Davenport organised this workshop and spoke.

2014: "New to Computing [Teaching]" — James H. Davenport co-organised this workshop with Higher Education Academy and spoke.