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Professional Summary

Since 1957, my research interests have been concerned mainly with ordinary differential equations having meromorphic coefficients on a region of the complex plane. During the last 25 years, the principal objects of my study have been relative invariants associated with particular kinds of differential equations. A relative invariant is a differential polynomial into which coefficients of differential equations can be substituted to exhibit invariant properties of equations under the two general types of transformations. Thus, the subject can be viewed as a very interesting area of differential algebra that has had only one recent explorer. Were it not for the guidance provided by computer-generated examples, the number of current explorers would likely be zero.

Publications - Abbrev

Book Roger Chalkley (2007). *Basic Global Relative Invariants for Nonlinear Differential Equations*. Providence, Rhode Island: American Mathematical Society. 2007A Author (pages 1-365 + xii) 978-0-8218-3991-1

Peer Reviewed Publications (1960). An IBM–704 code for a harmonics method applied to two-region spherical reactors. *Oak Ridge National Laboratory Report*, *2080*. 1960A

Book Roger Chalkley (2002). *Basic Global Relative Invariants for Homogeneous Linear Differential Equations*. Providence, Rhode Island: American Mathematical Society. 2002W Author (pages 1-204 + xi) 0-8218-2781-2

Peer Reviewed Publications (1960). On the second-order homogeneous quadratic differential equation. *Mathematische Annalen*, *141*, 87-98. 1960A

Peer Reviewed Publications (1963). A certain homogeneous-differential-equation transformation. *Arch. Math. (Basel)*, *14*, 186-192. 1963A

Peer Reviewed Publications (1974). Cardan's formulas and biquadratic equations. *Math. Mag.*, *47*, 8-14. 1974A

Peer Reviewed Publications (1975). A lattice of cyclotomic fields. *Math. Mag.*, *48*, 42-44. 1975A

Peer Reviewed Publications (1975). Bounds for difference quotients and derivates. *Amer. Math. Monthly*, *82*, 277-279. 1975A

Peer Reviewed Publications (1975). Circulant matrices and algebraic equations. *Math. Mag.*, *48*, 73-80.

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Peer Reviewed Publications (1976). Matrices derived from finite abelian groups. *Math. Mag.*, *49*, 121-129.

Peer Reviewed Publications (1977). A first-order algebraic differential equation. *J. Differential Equations*, *26*, 458-466.

Peer Reviewed Publications (1978). The perfect nth power which divides a nonzero polynomial. *Proc. Amer. Math. Soc.*, *68*, 147-148.

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Peer Reviewed Publications (1980). Explicit solutions of algebraic differential equations. *J. Differential Equations*, *35*, 275-290.

Peer Reviewed Publications (1981). Information about group matrices. *Linear Algebra Appl.*, *38*, 121-133.

Peer Reviewed Publications (1987). New contributions to the related work of Paul Appell, Lazarus Fuchs, Georg Hamel, and Paul Painlev´e on nonlinear differential equations whose solutions are free of movable branch points. *J. Differential Equations*, *68*, 72-117.

Peer Reviewed Publications (1989). Relative invariants for homogeneous linear differential equations. *J. Differential Equations*, *80*, 107-153.

Peer Reviewed Publications (1992). The differential equation Q = 0 in which Q is a quadratic form in y'', y', y having meromorphic coefficients. *Proc. Amer. Math. Soc.*, *116*, 427-435.

Peer Reviewed Publications (1992). A formula giving the known relative invariants for homogeneous linear differential equations. *J. Differential Equations*, *100*, 379-404.

Peer Reviewed Publications (1993). Semi-invariants and relative invariants for homogeneous linear differential equations. *J. Math. Anal. Appl.*, *176*, 49-75.

Peer Reviewed Publications (1994). A persymmetric determinant. *J. Math. Anal. Appl.*, *187*, 107-117.

Peer Reviewed Publications (1994). Lazarus Fuch's transformation for solving rational first-order differential equations. *J. Math. Anal. Appl.*, *187*, 961-985.

Peer Reviewed Publications (2002). Basic global relative invariants for homogeneous linear differential equations. *Mem. Amer. Math. Soc.*, *156*(744), 1- 204.

Peer Reviewed Publications (2007). Basic Global Relative Invariants for Nonlinear Differential Equations. *Mem. Amer. Math. Soc.*, *190*(888), 1-365.

Education

Institution:University of Cincinnati Cincinnati, Ohio 45221 Ph.D. 1958 Mathematics

Institution:University of Cincinnati Cincinnati, Ohio 45221 Ch.E. 1954 Chemical Engineering

Research and Practice Interests

My most recent publications are:

Basic Global Relative Invariants for Nonlinear Differential Equations, Memoirs of the American Mathematical Society 190 (November 2007), Number 888 (pages 1-365 + xii).

Basic Global Relative Invariants for Homogeneous Linear Differential Equations, Memoirs of the American Mathematical Society 156 (March 2002), Number 744 (pages 1-204 + xi).

Lazarus Fuchs' transformation for solving rational first-order differential equations, Journal of Mathematical Analysis and Applications, 187 (1994) 961 - 985.

A persymmetric determinant, Journal of Mathematical Analysis and Applications, 187 (1994) 107 - 117.

Semi-invariants and relative invariants for homogeneous linear differential equations, Journal of Mathematical Analysis and Applications, 176 (1993) 49 - 75.

A formula giving the known relative invariants for homogeneous linear differential equations, Journal of Differential Equations, 100 (1992) 379 - 404.

The differential equation Q = 0 in which Q is a quadratic form in y", y', and y having meromorphic coefficients, Proceedings of the American Mathematical Society , 116 (1992) 427 - 435.

Relative invariants for homogeneous linear differential equations, Journal of Differential Equations, 80 (1989) 107 - 153.

New contributions to the related work of Paul Appell, Lazarus Fuchs, Georg Hamel, and Paul Painlevé on nonlinear differential equations whose solutions are free of movable branch points, Journal of Differential Equations, 68 (1987) 72 - 117.

My principal research during the years 1995-2001 was published in March of 2002 as the Memoir of the American Mathematical Society (Number 744) titled “Basic Global Relative Invariants for Homogeneous Linear Differential Equations.” That Memoir presents remarkable new results of a rigorous nature for a subject that defied adequate treatment by mathematicians during the years from 1888 to1989. It is completely self-contained and consists of 204 + eleven pages. In particular, it presents simple explicit formulas for all of the basic relative invariants possessed by homogeneous linear differential equations. During the years 2001-2006, those results were extended to provide all of the basic relative invariants for general classes of nonlinear differential equations. The latter results were published in November of 2007 as the Memoir of the American Mathematical Society (Number 888) titled "Basic Global Relative Invariants for Nonlinear Differential Equations." It is also completely self-contained and it consists of 365 + twelve pages.

During the years 2006-2011, I have completed a thorough investigation about the various ways that two given relative invariants can be used to construct additional relative invariants. This area of research was practically untouched by previous investigators. Yet its precise development is essential for the main task of explicitly specifying all of the relative invariants having a given weight in terms of the basic relative invariants. I am currently preparing a monograph about this research. The results apply to any two relative invariants for any one of the classes of differential equations that I have previously examined. Currently, at least three more chapters must be written before I consider the monograph to be ready for publication.

We note in December of 2012 that the subject of relative invariants for differential equations will likely be mainly identified with my discoveries and developments during the last 25 years. Thus, I have a special responsibility to present my results carefully and as a recognizable branch of modern mathematics. In particular, a relative invariant is a type of differential polynomial and the subject can be viewed as a previously undeveloped area of differential algebra. The monograph that I have been working on since 2007 is now almost ready for submission. I have recently delayed sending it away until the newest version of MATHEMATICA, the just-released-in-December-of-2012-Version 9.0, could be checked and cited in my monograph for its suitability in regard to the computations. Unfortunately for the folks associated with MATHEMATICA, my programs immediately caught two very serious errors in its software. While Version 7.0 was completely reliable and Version 8.0 was satisfactory, Version 9.0 returns 1 as the evaluation of Sum[1,{k,k+1,m}] when it should return m – k; also, Version 9.0 returns 1 as the evaluation of Binomial[-1, -1] when it should return 0. They are significant bugs and I reported them immediately to the software engineers at Wolfram Inc. (as I had done earlier with bugs in the software for Versions 5.0 and 6.0). Because some of my research involves extremely complicated differential polynomials that can be computed in two completely different manners, it becomes obvious that something is wrong when the two methods yield different results. Then, the challenge is to isolate the difficulties as I have recently done.

Keywords

Relative Invariants for Ordinary Differential Equations

Courses Taught

15-MATH-253 CALCULUS III 004 Instr. Method:Lecture Max Enroll:41 Actual Enroll:39 Level:Undergraduate Academic Term:11A Regular Course 4

15-MATH-253 CALCULUS III 001 Instr. Method:Lecture Max Enroll:41 Actual Enroll:40 Level:Undergraduate Academic Term:11A Regular Course 4

Preferred Information

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