David Cook II

CURRICULUM VITÆ

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EMPLOYMENT

Eastern Illinois University, Charleston, Illinois
· Assistant Professor, Department of Mathematics & Computer Science, June 2014–*current*

University of Notre Dame, Notre Dame, Indiana
· Visiting Assistant Professor, Department of Mathematics, August 2012–May 2014

EDUCATION

University of Kentucky, Lexington, Kentucky
· Ph. D., Mathematics, May 2012
    · Advisor: Uwe Nagel
    · Thesis title: *Lefschetz properties and enumerations*
· M. A., Mathematics, December 2008

Tennessee Technological University, Cookeville, Tennessee
· B. S., *magna cum laude, in cursu honorum*, Computer Science, May 2007
· B. S., *magna cum laude, in cursu honorum*, Mathematics, May 2007

PUBLICATIONS

Refereed journal articles
[A13] *Partially ordered sets in Macaulay2* (with S. Mapes and G. Whieldon), J. Softw. Algebra Geom. **7** (2015), 9–15.
[A12] *On decomposing Betti tables and O-sequences*, Comm. Algebra (to appear), 10 pages; arXiv:1407.4085.
[A11] *Nested colorings of graphs*, Australas. J. Combin. **62(1)** (2015), 100–127. arXiv:1306.0140.
[A10] *The uniform face ideals of a simplicial complex*, J. Commut. Algebra (to appear), 52 pages; arXiv:1308.1299.
[A9] *The strong Lefschetz property in codimension two*, J. Commut. Algebra **6** (2014), no. 3, 323–344.
[A8] *The Lefschetz properties of monomial complete intersections in positive characteristic*, J. Algebra **369** (2012), 42–58; doi:10.1016/j.jalgebra.2012.07.015.
[A7] *Cohen-Macaulay graphs and face vectors of flag complexes* (with U. Nagel), SIAM J. Discrete Math. **26** (2012), no. 1, 89–101.
[A6] *Hyperplane sections and the subtlety of the Lefschetz properties* (with U. Nagel), J. Pure Appl. Algebra **216** (2012), no. 1, 108–114; doi:10.1016/j.jpaa.2011.05.007.
[A5] *The weak Lefschetz property, monomial ideals, and lozenges* (with U. Nagel), Illinois J. Math. **55** (2011), no. 1, 377–395.
[A4] *Nauty in Macaulay2*, J. Softw. Algebra Geom. **3** (2011), 1–4.

[A3] *The structure of the Boij-Söderberg posets*, Proc. Amer. Math. Soc. **139** (2011), no. 6, 2009–2015.

[A2] *Simplicial Decomposability*, J. Softw. Algebra Geom. **2** (2010), 20–23.

[A1] *Construction of a discrete divergence-free basis through orthogonal factorization in H-arithmetic* (with S. Le Borne), Computing **81** (2007), no. 4, 215–238.

Preprints

[P3] *The weak Lefschetz property for monomial ideals of small type* (with U. Nagel); submitted, 30 pages; arXiv:1507.3853.

[P2] *Signed lozenge tilings* (with U. Nagel); submitted, 23 pages; arXiv:1507.02507.

[P1] *An algebraic approach to finite projective planes* (with J. Migliore, U. Nagel, and F. Zanello); submitted, 21 pages; arXiv:1503.04335.

Conference proceedings (*non-refereed*)

[C2] *Solving Recurring Student Difficulties with Recurrence Relations* (with J. Byrd, M. Carter, P. Kirkham, M. Kosa), Proceedings of the 12th Annual SIGCSE/SIGCUE Conference on Innovation and Technology in Computer Science Education **39** (2007), no. 3, 343–343.

[C1] *TIAMAT: A new system for fragile image watermarking for image authentication* (with P. K. Rajan), Conf. Proc. of the Southeastern Symp. on Systems Theory (2006), 221–225.

MATHEMATICAL SOFTWARE

Macaulay2 packages

· *Graphs* (with J. Burkart and C. Jansen)

  · Provides routines for working with graphs and digraphs.

· *Nauty & NautyGraphs*

  · Provide interfaces with `nauty`, a tool for determining various properties of graphs.

  · Work with the extant and incompatible packages *EdgeIdeals* and *Graphs*, respectively.

· *Posets* (with S. Mapes and G. Whieldon)

  · Provides routines for working with partially ordered sets.

· *SimplicialDecomposability*

  · Determines k-decomposability and shellability for arbitrary simplicial complexes.

ADVISING

University of Notre Dame, Notre Dame, Indiana

· *Summer Research Advisor*:

  · 2013: Co-advised (with S. Mapes) two undergraduate students, Jack Burkart and Caroline Jansen, through writing a new package to handle graphs in *Macaulay2*. Taught the students the requisite mathematics to understand the algorithms used in the package.

TEACHING EXPERIENCE

Eastern Illinois University, Charleston, Illinois

· *Primary Instructor*:

  · MAT 4885: Theory of Computation; Fall 2015

  · MAT 3702: Probability and Statistics II; Fall 2015

  · MAT 3530: Abstract Algebra; Fall 2015

  · MAT 5990: Linear Algebra; Graph Theory; Summer 2015

- · MAT 3701: Probability and Statistics I; Spring 2015
- · MAT 1441: Calculus and Analytic Geometry I; Fall 2014, Spring 2015
- · MAT 5990: Algebraic combinatorics; Fall 2014
- · MAT 1160: Mathematics: A Human Endeavor; Summer 2014, Summer 2015
- · MAT 5990: Enumerative combinatorics; Summer 2014

University of Notre Dame, Notre Dame, Indiana

- · *Course Development*:
  - · MATH 40220: Intro. to Algebraic Combinatorics: Developed a new course on algebraic combinatorics for undergraduate mathematics majors during Spring 2013. The class focused on Stanley-Reisner correspondence and referenced modern research, when possible.
- · *Primary Instructor*:
  - · MATH 30710: Algebra; Spring 2014
  - · MATH 10120: Finite Mathematics; Fall 2013
  - · MATH 20610: Linear Algebra; Fall 2013
  - · MATH 40220: Intro. to Algebraic Combinatorics; Spring 2013
  - · MATH 22550: Calculus III; Fall 2012
  - · MATH 43900: Problem Solving in Mathematics; Fall 2012
- · *Algebraic Geometry Directed Reading Co-leader*: Responsible for co-leading several sessions of a directed reading course on algebraic geometry; met weekly in Spring 2013.

University of Kentucky, Lexington, Kentucky

- · *Primary Instructor*:
  - · MA 201: Mathematics for Elementary School Teachers; Spring 2011
  - · MA 112: Trigonometry; Fall 2010
  - · MA 109: College Algebra; Fall 2008, Spring 2009
- · *Algebra Preliminary Examination Review Organizer*: Responsible for arranging and leading four review sessions for the graduate preliminary examination in algebra in May 2010.
- · *Recitation Leader*:
  - · MA 113: Calculus I; Spring 2008
  - · MA 110: Pre-Calculus; Fall 2007

Service experience

External
- · Co-organizer for the "Combinatorial and Computational Algebra" special session at the AMS Meeting at Loyola University Chicago, October 2015.
- · Grant referee for *NSA Mathematical Sciences Program*.
- · Referee for *Communications in Algebra*, *Journal of Combinatorial Theory. Series A*, *Journal of Commutative Algebra*, *Graphs and Combinatorics*.
- · Reviewer for *Zentralblatt MATH*.

Eastern Illinois University, Charleston, Illinois
- · *ICTM Mathematics Contest Volunteer*, 28. February 2015
- · Putnam Competition Committee, Fall 2014–
- · Problem of the Week Committee, Fall 2014
- · Peer Review Committee (Evgeny Gordon), Fall 2014

University of Notre Dame, Notre Dame, Indiana
- *Northern Indiana Regional Science & Engineering Fair Judge*, 02. March 2013
  - Judged a K–12 science fair for the Senior (9–12) Division.
- *Putnam Mathematical Competition Organizer* (local), Fall 2012

University of Kentucky, Lexington, Kentucky
- *Kentucky Junior Academy of Sciences Volunteer*, 28. April 2012
  - Judged a high school mathematics oral presentation competition.
- *Search Committee – Mathematics Department Chair*, December 2011–January 2012
  - Represented the graduate student body during the search for a new department chair.
- *Sonia Kovalevsky High School Math Day Volunteer*, 29. October 2011
  - Helped with hands-on activities, grading competition answers, and general activities.
- *Mathematics Graduate Student Council President*, Fall 2011–Spring 2012
- *University of Kentucky's MathFest Booth Volunteer*, 04. August 2011
- *MathCounts Mathematics Competition Grader*, 19. February 2011
- *Graduate Student Colloquium Organizer*, Fall 2010

PRESENTATIONS

Invited talks at conferences
- *An algebraic approach to finite projective plane*
  - The Lefschetz Properties Workshop
    Mathematisches Institut, Georg-August-Universität, Göttingen, Germany, March 2015
- *Decomposing Betti tables and O-sequences*
  - Special Session on Topological Combinatorics and Combinatorial Commutative Algebra
    Fall Western Sectional Meeting of the AMS, San Francisco State University, October 2014
- *Betti tables of non-squarefree ideals associated to simplicial complexes*
  - Special Session on Geometric and Algebraic Combinatorics
    Spring Southeastern Sectional Meeting of the AMS, University of Tennessee, March 2014
- *Lozenge tilings, the weak Lefschetz property, and Laplace equations*
  - AMS Session on Geometric Applications of Combinatorics and K-Theory
    Joint Mathematics Meetings, Baltimore, Maryland, January 2014
- *Monomial ideals with persistent associated primes*
  - Special Session on Combinatorial Commutative Algebra
    Fall Eastern Sectional Meeting of the AMS, Temple University, October 2013
- *Cellular resolutions of non-squarefree ideals associated to simplicial complexes*
  - Special Session on Combinatorial Commutative Algebra
    Fall Southeastern Sectional Meeting of the AMS, University of Louisville, October 2013
- *Lozenge tilings and the weak Lefschetz property*
  - Mini-symposium on Software for Algebraic Geometry: Macaulay2
    SIAM Conference on Applied Algebraic Geometry, Colorado State University, August 2013
- *The Lefschetz properties of monomial complete intersections in positive characteristic*
  - Workshop on Syzygies
    Cornell University, November 2012
- *The weak Lefschetz property for type two monomial algebras*
  - Special Session on Combinatorial Commutative Algebra
    Fall Southeastern Sectional Meeting of the AMS, Tulane University, October 2012

- *Enumerations deciding the weak Lefschetz property*
  - Special Session on Enumerative and Algebraic Combinatorics
    Joint Mathematics Meetings, Boston, Massachusetts, January 2012
- *Punctured hexagons and almost complete intersections*
  - Special Session on Commutative Algebra and Combinatorics
    Canadian Mathematical Society Winter Meeting, U. of British Columbia, December 2010
- *Clique-whiskering and face vectors*
  - Special Session on Combinatorial Algebra
    Fall Southeastern Sectional Meeting of the AMS, University of Kentucky, March 2010
- *TIAMAT: A new system for fragile image watermarking for image authentication*
  - Southeastern Symposium on Systems Theory, Tenn. Tech. University, March 2006

Posters presented at conferences & academic events
- *Enumerations deciding the weak Lefschetz property* (with U. Nagel)
  - MAA MathFest 2011, Lexington, Kentucky, August 2011
  - Midwest Commutative Algebra and Geometry Conference, Purdue University, May 2011
- *New mathematical techniques for fluid flow simulation* (with S. Le Borne)
  - Student Research Day, Tennessee Technological University, April 2007
  - Posters at the Capitol, Nashville, Tennessee, February 2007

Workshops attended by invitation
- *Lefschetz Properties and Artinian Algebras*, March 2016
  - Banff International Research Station, Banff, Candada
- *The Lefschetz Properties*, March 2015
  - Mathematisches Institut, Georg-August-Universität, Göttingen, Germany
- *IMA Special Workshop: Macaulay2*, July 2011
  - Institute for Mathematics and Its Applications, Minneapolis, Minnesota
- *Mathematical Research Communities: Commutative Algebra*, June 2010
  - Snowbird, Utah
- *Macaulay2 Workshop*, January 2010
  - Mathematical Sciences Research Institute, Berkeley, California

Eastern Illinois University, Charleston, Illinois
- Colloquium: October 2014

University of Notre Dame, Notre Dame, Indiana
- Algebra Seminar: November 2012, November 2013
- Discrete Mathematics Seminar: October 2012, March 2013

University of Kentucky, Lexington, Kentucky
- Algebra Seminar: February 2010, November 2010, February 2011, November 2011
- CATS (Combinatorics, Algebra, Topology, and Statistics) Seminar: September 2010
- Graduate Colloquium: March 2008, February 2009, February 2010, April 2011
- Summer Research Seminar: July 2010

GRANTS & AWARDS

Eastern Illinois University, Charleston, Illinois
- · President's Fund for Research and Creative Activity (2015–2016); $14,500.
- · Early Research Support Grant (2014); $500.

University of Kentucky, Lexington, Kentucky
- · Dissertation Year Fellowship, 2011–2012
    - · One of ten university-wide fellowships for excellence in research.
- · Wimberly C. Royster Outstanding (Mathematics) Teaching Assistant Award, 2011–2012
    - · A departmental fellowship issued to one student for excellence in teaching and research.
- · Max Steckler Graduate Fellowship, 2009–2011
- · Kentucky Opportunity Fellowship, 2009–2010
    - · A departmental fellowship issued to one doctoral student for excellence in research.
- · Enochs Graduate Scholarship for Algebra, 2009–2010
- · Summer Research Assistantships, 2008–2011

MEMBERSHIPS

- · *American Mathematical Society*, Mathematics Professional Society, since 2007
- · *Kappa Mu Epsilon*, Mathematics Honor Society, since 2005
- · *Alpha Mu Gamma*, Foreign Language Honor Society, since 2004
    - · Inducted for studies in the German language
- · *Tennessee Technological University Honors Program*, 2002–2007