Gautam Dasgupta
620 Seeley W. Mudd, Civil Engineering & Engineering Mechanics
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I: Academic background

(a) Undergraduate degree: B. E. College, Calcutta University;
Civil Engineering, BE 1967

(b) Master's degree: B. E. College, Calcutta University;
Applied Mechanics, ME 1969

(c) Doctoral degree: U. C. Berkeley; Structural Mechanics; PhD 1974

(d) Postdoctoral Appointment: U. C. Berkeley; Structural Mechanics; 1974 –77

II: Current position
Columbia University, Professor, Civil Engg. Engg. Mech.,
(first appointment: 1977 as Assist. Prof.);
`dasgupta@columbia.edu`; `http://www.columbia.edu/~gd18`

III: Publications
Journal: 21 (single author), 21 (joint); Proceedings: exceeds 50;
Invited Papers: exceeds 12;
Invited Seminars: National exceeds 50; International exceeds 75;
Editorial Boards and Reviewers: International Journal exceeds 25;

IV: Fellowship

(a) Alexander von Humboldt Stiftung, Germany, 1986– 1987

(b) Fulbright Senior Professorship, Washington D.C., 1998-2001

(c) Tsunoda Senior Fellowship, Waseda University, Japan, January/August 2013

(d) Guest *Associate Professor*

i. Technische Universität, Wien, Austria, 1982-92
ii. Bundeswahr Universität, Hamburg, Germany, 1986-87
iii. Technische Universität, Braunschweig, Germany, 1993-94

(e) Guest *Professor*

i. National Science Council Fellowship, Murmansk U, Russia, 1997
ii. Indian Institute of Technology, Kharagpur, India, 1998,
iii. Indian Statistical Institute, Calcutta, India, 1999,
iv. Laboratoire d'Optique P.M. Duffieux, Université de Franche-Comté, Besançon, France, currently from 2001 to present, *Senior visiting scholar*

V: Cumulative Research Grant and patents:

(a) National Science Foundation: $916,000
National Institutes of Health: $300,000
(as Prncipal Investigator: $1,091,000; co- Prncipal Investigator: $375,000)

(b) Columbia University Academic Quality Fund: $250,000

(c) Combined International Research Grants as PI: $857,000

(d) U.S. Patent No. 6,101,450 of Gautam Dasgupta for "Stress Analysis Using a Defect-Free Four Node Finite Element Technique" — via Columbia University

(e) U.S. Patent Pending of Gautam Dasgupta for "EMERGENCY RESPONSE MANAGEMENT APPARATUSES, METHODS AND SYSTEMS " Serial No.: 13/310,547 Docket No.: 21544-001US Filed: December 2, 2011 Conf. No.: 6232 Art Unit: 2857 Electronic Filing — via LiveDesign Technologies International, NY, NY

VI: Collaboration with Senior Researchers

(a) Prof. J. J. Connor, MIT — *emergency management*

(b) Prof. G. Leitmann, U. C. Berkeley — *varitional calculus and optimization*

(c) Prof. L. A. Zadeh, U. C. Berkeley — *fuzzy logic*

(d) Dr. E. L. Wachspress, Prof. Emeritus, U. Tenn and U.C. Berkeley — *mathematical modeling with rational basis functions*

(e) Sir F. Thackeray, Transvaal Museum, Pretoria, South Africa — *morphometric anthropology*

(f) Dr. J. Treil, (Chevalier dans l'Ordre National de la Lgion d'Honneur)
Clinique Pasteur, Toulouse, France — *cranio-facial calculations*

VII: Consulting Experiences

(a) Foundation Engineering: Bechtel Corporation, 1972 – 1974

(b) Probabilistic Structural Analysis: NASA- Lewis Center, 1981 –1985

(c) Computer Mathematics Research Consultant:
Rovaniemi Polytechnic and Rovaniemi and Business Advantage, Espoo, Finland, 1991 – 1995

VIII: Editorship and Chair

(a) ASCE, J. Engg. Mech. (Elasticity, 1980 – 1985)

(b) ASCE, J. Engg. Mech. (Bioengineering, 1990 – 1995)

(c) International *Mathematica* Symposium
(Founding Chair, Executive Committee Chair: 1995 – 2003)

Theorems and Algorithms: Original Derivation

Theorems published

Elastic – viscoelastic Analogy

Derived an integral representation for viscoelastic harmonic respones from the elastic counterpart, *vide*[10][1]. This accelerated the conventional method by a thousand fold.

Illposed problems in elasticity

Extended Almansi's *isotropic* elasticity theorem for conditional solution to *anisotropy*, *vide*[4]. This made possible for the boundary element method to solve problem when the stresses and displacements were simultaneously prescribed on a boundary subset.

Identification of simulation of terrorism

Proved that the extreme distribution of type-2, Fréchet distribution, is the unique probabilistic description to model terrorism and perform simulation for training the first responders. Disclosure in [11].

Algorithms published

Bessel function convolution for responses in unbounded media, *vide*[1]

Substructure deletion, *vide*[2]

Cloning algorithm

For harmonic excitations, radiation damping due to, are captured *for the first time* as the imaginary part of the dynamic stiffness matrix from the real valued finite element element stiffness and mass matrices via a matrix quadratic equation, *vide*[3].

Stochastic boundary element with stochastic Green's function, *vide*[5]

Stochastic finite element with stochastic shape function *vide*[8]

Simultaneous sensitivity evaluation in symbolic computation, *vide*[12]

Weights for Wachspress coordinates, *vide*[7]

Exact integration within polygons, *vide*[6]

Analytical formulations for incompressible and compressible finite elements

Quadrilaterals — convex, concave and degenerated triangles — with *unique* locking- free shape functions and *exact* stiffness matrix are derived from quadratic polynomial Rayleigh modes. Kinematic constraints are deduced for incompressibility, *vide*[9].

[1] citations in p. 4

Citations in Theorems and Algorithms, p. 3

[1] G. Dasgupta. A numerical solution for viscoelastic half planes. *Journal of the Engineering Mechanics Division*, 102(EM4):601 – 612, August 1976.

[2] G. Dasgupta. Foundation impedance matrices by substructure deletion. *Journal of the Engineering Mechanics Division*, 106(EM3):517 — 523, 6 1980.

[3] G. Dasgupta. A finite element formulation for unbounded homogeneous continua. *Journal of Applied Mechanics*, 104:136 — 140, 3 1982.

[4] G. Dasgupta. Validity of Almansi theorems for anisotropic boundary elements. *Journal of Engineering Analysis*, 5(2):89–94, June 1988.

[5] G. Dasgupta. Green's functions for random media. *Journal of the Chinese Institute of Engineers*, 23:1–8, 2000.

[6] G. Dasgupta. Integration within polygonal finite elements. *Journal of Aerospace Engineering, ASCE*, 16(1):9–18, January 2003.

[7] G. Dasgupta. Interpolants within convex polygons: Wachspress' shape functions. *Journal of Aerospace Engineering, ASCE*, 16(1):1–8, January 2003.

[8] G. Dasgupta. Stochastic shape functions and stochastic straindisplacement matrix for a stochastic finite element stiffness matrix. *Acta Mechanica*, 195(1-4):379–395, January 2008.

[9] G. Dasgupta. Incompressible and locking-free finite elements from Rayleigh mode vectors. *Acta Mechanica*, 223:1645 – 1656, August 2012.

[10] G. Dasgupta and J. L. Sackman. An alternative representation of the elastic-viscoelastic analogy. Report EERC 75-22, University of California, Berkeley, California, 1975.

[11] Gautam Dasgupta. EMERGENCY RESPONSE MANAGEMENT APPARATUSES, METHODS AND SYSTEMS. Chadbourne and Parke, LLP,— via LiveDesign Technologies International, NY, NY; application under review: *patent pending*, December 2, 2011 Conf. No.: 6232 Art Unit: 2857 Electronic Filing. U.S. Patent Application.

[12] V. Keränen and P. Mitic, editors. *Innovationin Mathematics: Proceedings of the Second International Mathematica Symposium*, Computational Mechanics Publications, Southampton, Boston, 1977.

Archived Journal Papers and Book sections

Single authored

1. A numerical solution for viscoelastic half planes, *Journal of the Engineering Mechanics Division,* American Society of Civil Engineers, New York, NY, vol. 102, no. EM4, August 1976, pp. 601 – 612.
2. Foundation impedance matrices by substructure deletion, *Journal of the Engineering Mechanics Division,* American Society of Civil Engineers, New York, NY, vol. 106, no. EM3, June 1980, pp. 517 – 523.
3. Viscoelastic responses of finite bodies by Quadrature form of correspondence principle, *Journal of Applied Mechanics,* ASME, New York, NY, vol. 48, March 1981, pp. 206 – 207.
4. A finite element formulation for unbounded homogeneous continua, *Journal of Applied Mechanics,* ASME, New York, NY, vol. 104, March 1982, pp. 136 – 140.
5. Computation of exterior potential fields by infinite substructuring, *Computer Methods in Applied Mechanics and Engineering,* Elsevier Science (North-Holland), vol. 46, 1984, pp. 295 – 305.
6. Evaluation of added mass by a cloning algorithm, *International Journal of Numerical Methods in Engineering,* vol. 21, 1985, pp. 1157–1164.
7. Validity of Almansi theorems for anisotropic boundary elements, *International Journal of Engineering Analysis,* Computational mechanics Publication, (CMPL) Ashurst, UK, vol. 5, no. 2, 1988, pp. 89–94.
8. Boundary elements with Mathematica, *International Journal of Software Engineering,* CMPL, vol. 6, no. 1, January 1990, pp. 1–10.
9. Boundary Modulation, *International Journal of Software Engineering, Advances in Boundary Elements,* CMPL, vol. 9, 1992, pp. 247–253.
10. Approximate dynamic responses in random media, *Acta Mechanica*, Springer Verlag, 1992, vol.3, pp. 99-114.
11. G. Dasgupta, Stochastic Constitutive Modeling for Electrorheological Media, *International Journal of Intelligent Material Systems and Structures,* Technomic, Lancaster, Pennsylvania, USA, June 1994, pp. 88 – 100.
12. Stochastic boundary elements, Probabilistic Engineering Mechanics, CMPL, vol. 12, no. 4, 1997, pp. 290–294.
13. Finite elements beyond Courant's Triangulation, Innovation in Mathematics, Computational Mechanics Publication, Ashurst, UK, May 1997, pp. 107-114.
14. Iterative Simulation for Stochastically Nonlinear Large Variability, J. Aero. Enggr. ASCE, vol. 13, no. 1, January 2000, pp. 11–16.
15. Green's Functions for Random Media, J. Chinese Institute of Engineers, Nat. Taiwan Univ. Sc. and Tech. Taipei, Taiwan, vol. 23, no. 3, May 2000, pp. 1–8.
16. Interpolants Within Convex Polygons: Wachspress' Shape Functions, *Journal of Aerospace Engineering,* ASCE, vol. 16, no. 1, January 2003, pp. 1–8.
17. Integration Within Polygonal Finite Elements, *Journal of Aerospace Engineering,* ASCE, vol. 16, no. 1, January 2003, pp. 9–18.
18. Closed-Form Isoparametric Shape Functions of Four-Node Convex Finite Elements,

Journal of Aerospace Engineering, ASCE, Vol. 21, Issue 1,January 2008, pp. 10-18.

19. Stiffness Matrices of Isoparametric Four-Node Finite Elements by Exact Analytical Integration, *Journal of Aerospace Engineering,* ASCE, Vol. 21, Issue 2, April 2008, pp. 45-50.
20. Stochastic shape functions and stochastic strain-displacement matrix for a stochastic finite element stiffness matrix, *Acta Mechanica,* Springer Verlag, Wien, vol. 195, no. 1-4, 2008, pp. 379 – 395.
21. Incompressible and Locking-free Finite Elements from Rayleigh Mode Vectors, *Acta Mechanica,* Springer Verlag, Wien, vol. 223, no. 8, 2012, pp. 645 – 1656,

Refereed Sections in Archived Books

22. Sommerfeld radiation conditions and cloning algorithm, New Concepts in Finite Element Analysis, American Society of Mechanical Engineers, New York, NY, AMD-vol. 44, 1981, pp. 47–66.
23. *Numerical Methods for Transient and Coupled Problems,* Editors: P. Bettess, E. Hinton, R. W. Lewis, Wiley series in numerical methods in engineering, Venice, Italy, 9-13 July 1984
24. Green's functions for inhomogeneous media for boundary elements, *Advances in Boundary Elements,* CMPL, 1989, pp. 37-46.
25. Boundary elements with macro shape functions, *Advances in Boundary Elements,* CMPL, 1989, pp. 253-262.
26. Reliability analysis with `Interval` arithmetic, *Mathematics with Vision,* Computational Mechanics Publication, Ashurst, UK, 1995, pp. 111-118.
27. Tessellica: A defect-free finite element paradigm, *Journal on Logic, History and Educational Computing,* Computer Science, Helsinki University of Technology, Helsinki, Finland, 1996, pp. 230-242.
28. Finite Elements beyond Courant's Triangulation, *Innovation in Mathematics,* Computational Mechanics Publication, Ashurst, UK, 1997, pp. 107-114.
29. System Stochasticity: Discrete Formulation with Mathematica, *IMS*'99,CD Publication #56, Research Institute for Symbolic Computation Hagenberg, Austria, 1999. Download from: `http://www.risc.jku.at/about/conferences/summer99/ims99/`

Joint Publication: Archived Journal Papers

30. Chopra, A. K., Chakrabarty, P. and Dasgupta, G, Dynamic stiffness matrices for viscoelastic half-plane foundations, Journal of the Engineering Mechanics Division, ASCE, vol. 102, no. EM3, proc. paper 12209, June 1976, pp. 497–514.

31. G. Dasgupta and J. M. Kelly, Projectile impact on a thin, flexible structure: A singular dynamic contact phenomenon, Journal of Structural Mechanics, Marcel Dekker, vol. 5, no. 1, 1977, pp 19 – 31.

32. G. Dasgupta and J. L. Sackman, An alternative representation of the elastic-viscoelastic correspondence principle for harmonic oscillations, Journal of Applied Mechanics,

American Society of Mechanical Engineers, New York, NY, vol. 99, no. 1, March 1977, pp. 57 – 60.

33. G. Dasgupta and J. M. Kelly, Analysis of localized dynamic contact on structures using matched asymptotic expansions, Journal of Structural Mechanics, Marcel Dekker, vol. 6, no. 1, 1978, pp 29 – 44.

34. G. Dasgupta and J. L. Sackman, A Quadrature representation of the viscoelastic analogy in the frequency domain, Journal of Applied Mechanics, ASME, vol. 45, December 1978, pp 955 –956.

35. G. Dasgupta and A. K. Chopra, Dynamic stiffness matrices for viscoelastic half planes, J. Engineering Mechanics Division, ASCE, New York, NY, vol. 105, no. EM5, October 1979, pp. 729 – 745.

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37. M. L. Moss, H. Vilmann, G. Dasgupta and R. Skalak, Craniofacial growth in space-time, Craniofacial Biology, Monograph no. 10, Craniofacial growth series, Center for Human Growth and Development, 1981, pp. 61 – 81.

38. R. Skalak, G. Dasgupta, M. L. Moss, E. Otten P. Dullemeijr, and H. Vilmann, Analytical Description of Growth, Journal of Theoretical Biology, vol. 94, 1982, pp. 555 – 577.

    item L-J Lee and G. Dasgupta, Interaction of nonlinear interiors with linear infinite exteriors, Computers and Structures, Pergamon Press, vol. 20, no. 1, 1985, pp. 339–353.

39. X. Lee and G. Dasgupta, Analysis of structural variability with computer algebra, Journal of Engineering Mechanics, ASCE, New York, NY, vol. 114, no. 1, January 1988, pp. 161 – 171.

40. Yamazaki, F., Shinozuka, M., and Dasgupta, G.: Neumann expansion for stochastic finite element analysis, J of Enggr. Mech., ASCE, vol 114, no. 8, 1988, pp 1335–1354.

41. A. P. S. Selvadurai and G. Dasgupta, Harmonic response of smoothly embedded rigid sphere, Journal of Engineering Mechanics, ASCE, New York, NY, vol. 116, no. 9, September 1990, pp. 1945 – 1958.

42. O. Vilmann, and G. Dasgupta, Fundamental solutions for stochastic Mindlin plates, International Journal of Engineering Analysis, CMPL, vol. 9, 1992, pp. 47–59.

43. Gyebi, O. K., and Dasgupta, G., Finite element analysis of viscoplastic soils with Q-factor, International Journal for Soil Dynamics and Earthquake Engineering, Springer Verlag, vol. 11, no. 4, 1992, pp. 187-192.

44. McAlarney, M. E. , G. Dasgupta, M. L. Moss and L. Moss-Salentijn, Anatomical macroelement in the study of cranial facial rat growth, Journal of Cranial Facial Growth and Developmental Biology, New York, New York, USA, vol. 12, 1992, pp. 3–12.

45. Weiner, C, M. Sára, G. Dasgupta and U. B. Sleytr, Affinity Cross-Flow Filtration: Purification of IgG with a Novel Protein Affinity Matrix Prepared from Two-Dimensional Protein Crystals, Biotechnology and Bioengineering, John Wiley, vol. 44, 1994, pp. 55 – 65.

46. Andre S. Publico and M. E. McAlarney and L. Moss-Salentijn and G. Dasgupta, Further investigations into a non-landmark tensorial form difference tecnique, Bioengineering 1997, American Society of Mechanical Engineers, April 1997, pp. 565–566.

47. Gautam Dasgupta and Jacques Treil, "Maxillo-Facial Frame: Finite Element Shapes," *The Mathematica Journal,* vol. 8, no. 3. 2001, pp. 235–246.

48. Elisabeth A. Malsch and Gautam Dasgupta, "Interpolation constraints and thermal distributions: a method for all non-concave polygons, Book of Abstracts, 14th US National Conference: Special Mechanics Session in Honor of Bruno Boley," *International Journal of Solids and Structures,* vol. 41, no. 8, 2004, pp. 2165–2188.

49. Elisabeth A. Malsch and Gautam Dasgupta, "Algebraic construction of smooth interpolants on polygonal domains," *Challenging the Boundaries of Symbolic Computation,* Imperial College Press 2003
Download: `http://library.wolfram.com/infocenter/Books/4957/`

    vol. 9, no. 6., issue 3, 2004.

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Download: `http://jgt.akpeters.com/papers/MalschEtAl05/`

Teaching at Columbia University (from 1977)

The levels are indicated in parentheses
key: 1000–Freshman, 3000–Junior/senior, 4000–Senior/MS, 6000–MS/PhD, 8000–PhD

1. Undergraduate courses

   (1) Mechanics of solids (3000)
   (2) Structural analysis (3000)
   (3) Dynamics and vibrations (3000)
   (4) Partial differential equations (3000)
   (5) Computer programming with FORTRAN (1000)
   (6) Gateway Lab: Introduction to *Mathematica* (1000)

2. Graduate courses

   (1) Partial differential equations (4000)
   (2) Mechanics of solids (4000)
   (3) Structural analysis (4000)
   (4) Finite element method (4000)
   (5) Advanced finite element method (6000)
   (6) Computer aided engineering graphics (4000)
   (7) Reliability analysis (4000)
   (8) Mechanics of fracture and fatigue (4000)
   (9) Advanced mechanics of solids: viscoelasticity and plasticity (4000)
   (10) Continuum mechanics: elasticity (6000)
   (11) Continuum mechanics: elasticity (8000)
   (12) Continuum mechanics: inelasticity (8000)
   (13) Plates and Shell (4000)

3. Research & Report

   (1) Stochastic finite element method (6000)
   (2) Morphometric shape analysis (6000)
   (3) Stochastic boundary element method (6000)
   (4) Surface graphics (6000)