Résumé: Raphael Blumenfeld (November 2003)

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Education

1985-89 Ph.D., Physics - Tel Aviv University. *Random systems - Nonlinear conductivity and distributions*, Supervisors: Profs. Amnon Aharony and David J. Bergman. Magna cum Laude.
1983-85 M.Sc., Physics - Tel Aviv University. *Nonlinear random resistor networks, topological problems and fluctuations*, Supervisor: Prof. Amnon Aharony, Magna cum Laude.
1980-83 B.Sc., Physics - Tel Aviv University, Magna cum Laude.

Employment / Appointments

1998-present Visiting Scientist, Cavendish Laboratory, Cambridge University, UK
1997-98 Project Leader, Mesoscale group, R & D, Molecular Simulations Inc (now Accelrys), Cambridge, UK
1996-97 Research Scientist, Cambridge Hydrodynamics Inc (led by Prof S.A. Orszag), Princeton, NJ, USA
1993-96 Director's Fellow, Los Alamos National Laboratory, NM, USA
1992-93 Research Associate, Princeton University (with Prof S. Torquato), NJ, USA
1989-92 Research Associate, Cavendish Laboratory (with Prof R. C. Ball), Cambridge University, UK
1987 Visiting Research Scientist, IBM (with Prof B. B. Mandelbrot), Yorktown Heights, USA

Honors / Awards

1993-6 Director's Fellowship, Los Alamos National Laboratory
1990-2 Leo Baeck Lodge grant
1989 Scholarship Award, Weiler Foundation
1985, 1988-9 Distinction Award, Tel Aviv University
1982-8 Scholarship, Tel Aviv University

Organization / Professional Activities

2004 Programme Committee, SPIE conference *Fluctuation and Noise, FaN2004*, Maspalomas, Gran Canaria, Spain, 25-28 May
2003 Chairman, *Statics and Dynamics of Systems of Rigid Particles*, Isaac Newton Institute, Cambridge, UK 10 December
2003 Organizing Committee, SPIE conference *Fluctuation and Noise, FaN2003*, Santa Fe, NM, USA, 1-4 June
1999-2001 Specialist Subject Reviewer, Quality Assurance Agency (QAA) for Higher Education, UK
2000 Organising Committee Member, MESOMECHANICS2000, China
1995 Organiser and Chairman, Workshop on *Fractal Analysis and Modelling of Materials*, Los Alamos National Laboratory, USA
1994-96 Organiser and Chairman, *Working Group on Protein Dynamics*, CNLS, Los Alamos National Laboratory, USA

Publications (See attached list)

850 citations (Source: ISI Science Citation Index, October 2003)
59 papers in primary peer reviewed journals (further 6 submitted)
20 contributions to Symposia and compiled volumes
15 papers in various stages of preparation

Colloquia, invited talks, presentations

15 invited colloquia and departmental seminars

Over 50 invited group seminars
Over 40 invited presentations in conferences
Over 35 presentations in conferences as a regular speaker

Publications

850 citations on October 2003 according to ISI Science Citation Index

I. Refereed and recently submitted papers in primary journals

65. R. Blumenfeld,
Explicit solutions for the stress field in isostatic systems and prediction of force chains, Phys. Rev. Lett., submitted.
64. R. Blumenfeld,
Stresses in granular systems and emergence of force chains, Nature, submitted.
63. R. Blumenfeld,
Stress in planar cellular solids: Coarse-graining the constitutive equation, Phys. Rev. Lett., submitted.
62. R. Blumenfeld,
Strange dynamics of domain walls and periodic stripes on antiferromagnetic chains, EuroPhys. Lett., submitted; cond-mat/0108470.
61. R. Blumenfeld, S. F. Edwards and R. C. Ball,
Granular matter and the marginal rigidity state, Nature, submitted; cond-mat/0105348.
60. R. Blumenfeld,
Large fluctuations in disentaglement forces and implications for dynamics, Phys. Rev. **E**., submitted.
59. R. C. Ball and R. Blumenfeld,
From Plasticity to a renormalisation group, Phil. Trans. R. Soc. Lond. 360 , 731 (2003); cond-mat/0301562.
58. R. Blumenfeld and S. F. Edwards,
Granular entropy: Explicit calculations for planar assemblies, Phys.Rev. Lett. **90**, 114303 (2003); cond-mat/0303418.
57. R. Blumenfeld,
Stress transmission in planar disordered solid foams, J. Phys. A: Math. Gen., submitted (2002); cond-mat/0210336.
56. R. C. Ball and R. Blumenfeld,
The stress field in granular systems: Loop forces and potential formulation, Phys. Rev. Lett. **88**, 115505 (2002); cond-mat/0008127.
55. R. Blumenfeld,
Dynamics of twists on antiferromagnetic spin chains: Theory, Eur. Phys. J. **B 29**, 261 (2002).
54. R. Blumenfeld and R. Balakrishnan
Exact multi-twist solutions for the Belavin-Polyakov equation and application to magnetic systems, J. Phys. A, **33**, 2459 (2000).
53. R. Blumenfeld,
Pulling a chain's leg: The pullout dynamics of entangled chain, Macromolecules, **32**, 1082 (2000).
52. R. Blumenfeld
Hierarchical structure of domain walls in magnetic layers, Phase Transitions, **69**, 237 (1999).
51. R. Blumenfeld
Dynamics of fracture prpagation in the mesoscale: Theory, Theor. And Appl. Frac. Mech. **30**, 209 (1998).
50. R. Balakrishnan and R. Blumenfeld
On the twist excitations in a classical anisotropic antiferromagnetic chain, Phys. Lett. **A 237**, 69 (1997).
49. A.E. Garcia, R. Blumenfeld, G. Hummer and J. A. Krumhansl,
Multi-Basin Dynamics of a Protein in a Crystal Environment, Physica **D 107**, 225, (1997).
48. R. Balakrishnan and R. Blumenfeld
Transformation of general curve evolution to a modified Belavin-Polyakov equation, J. Math. Phys.**38**, 5878 (1997)
47. R. Blumenfeld and Benoit B. Mandelbrot
Mass fractal lacunarity, Lévy dusts, Mittag-Leffler statistics, and perceived dimension, Phys. Rev. **E 56**, 112 (1997).

46. R. Blumenfeld
Planar curve representation of many-body systems and dynamics Phys. Rev. Lett., **78**, 1203 (1997).
45. B. L. Holian, R. Blumenfeld and P. Gumbsch
An Einstein model of brittle crack propagation, Phys. Rev. Lett. **78**, 78 (1997).
44. R. Blumenfeld
Nonequilibrium brittle fracture propagation: Steady state, oscillations and intermittency, Phys. Rev. Lett. **76**, 3703 (1996).
43. R. Blumenfeld
Pattern formation in Laplacian growth: Theory, Center for Nonlinear Studies Newsletter **112**, April (1995); cond-mat/9505116.
42. R. Blumenfeld and R. C. Ball
Two dimensional Laplacian growth as a system of creating and annihilating particles, Phys. Rev. **E**, Physical Review **E 51**, 3434 (1995); cond-mat/9401068.
41. R. Blumenfeld
Formulating a first-principles statistical theory of growing surfaces in two-dimensional Laplacian fields, Phys. Rev. **E 50**, 2952 (1994); cond-mat/9408039.
40. V. Milman, N. A. Stelmashenko and R. Blumenfeld
Fracture surfaces: A critical review and a morphological analysis of scanning tunneling microscopy measurements, Progress in Materials Science **38**, 425-474 (1994).
39. R. Blumenfeld
Two dimensional Laplacian growth can be mapped onto Hamiltonian dynamics, Phys. Lett. **A 186**, 317-322 (1994).
38. R. Blumenfeld and R. C. Ball
Quantifying morphology of scale-invariant structures beyond the fractal dimension, Fractals **1**, 985-991 (1993).
37. R. Blumenfeld and S. Torquato
A coarse-graining procedure to generate and analyze heterogeneous materials: Theory, Phys. Rev. **E 48**, 4492-4500 (1993).
36. V. Milman, R. Blumenfeld, N. A. Stelmashenko and R. C. Ball
Experimental measurements of the roughness of brittle cracks, Phys. Rev. Lett. **71**, 204 (1993).
35. R. Blumenfeld
Explicitly exact solutions for waves in a family of nonlinear media, Physica **D 66**, 7-13 (1993).
34. R. Blumenfeld and R. C. Ball
A probe for morphology and hierarchical correlations in scale invariant structures, Phys. Rev. **E 47**, 2298-2302 (1993).
33. J. Adler, A. Aharony, R. Blumenfeld, A. B. Harris and Y. Meir
The distribution of the logarithms of currents in percolating resistor networks, II. Series expansion, Phys. Rev. **B 47**, 5770-5782 (1993).
32. A. Aharony, R. Blumenfeld and A. B. Harris
The distribution of the logarithms of currents in percolating resistor networks, I. Theory, Phys. Rev. **B 47**, 5756-5769 (1993).
31. C. Bowen, D. L. Hunter, R. Blumenfeld and N. Jan
Magnetism and high Tc superconductors, J. Physique I France **3**, 83-92 (1993).
30. R. C. Ball and R. Blumenfeld
Universal scaling of the stress field at the vicinity of a wedge crack in two dimensions and oscillatory self-similar corrections to scaling, Phys. Rev. Lett. **68**, 2254 (1992).
29. E. Duering, R. Blumenfeld, D. J. Bergman, A. Aharony and M. Murat
Current distributions in a two-dimensional random-resistor-network, J. Stat. Phys. **67**, 113-121 (1992).
28. R. Blumenfeld,
An exact solution for electromagnetic waves in strongly nonlinear media, J. Phys. **A**: Math. Gen. **25**, L275-L282 (1992).
27. R. Blumenfeld and R. C. Ball
Onset of scaling behaviour in 2D slow cracking, Modern Phys. Lett. **B 5**, 1567-1573 (1991).

26. R. Blumenfeld and D. J. Bergman
Strongly nonlinear composite dielectrics: a method for exact solution for the potential field and effective bulk properties, Phys. Rev. **B 44**, 7378-7386 (1991).
25. R. Blumenfeld and R. C. Ball
Onset of scale-invariant pattern in growth processes: The cracking problem, Physica **A 177**, 407-415 (1991).
24. R. C. Ball, P. W. H. Barker and R. Blumenfeld
Sidebranch selection in fractal growth, EuroPhys. Lett. **16**, 47-52 (1991).
23. R. Blumenfeld
The functional form of the $T_c(x)$ line in the phase diagram of high temperature superconductors, Physica **C 178**, 119-124 (1991).
22. R. C. Ball and R. Blumenfeld
Exact results on exponential screening in two-dimensional diffusion limited aggregation, Phys. Rev. **A 44**, R828-R831 (1991).
21. R. Blumenfeld and D. J. Bergman
Nonlinear susceptibilities of granular matter, Phys. Rev. **B 43**, 13682-13683 (1991).
20. R. Blumenfeld
Geometrical correlations and the origin of x values at the maximum and intersects of $T_c(x)$ in $La_{2-x}Sr_xCuO_4$, J. de Physique **1**, 159-166 (1991).
19. G. Corsten, C. Liem, R. Blumenfeld and N. Jan
Pairing of holes via vortex/antivortex attraction in doped $La_{2-x}Sr_xCuO_4$, J. de Physique **51**, 2229-2233 (1990).
18. R. Blumenfeld and A. Aharony
Breakdown of multifractal behaviour in diffusion limited aggregates Phys. Rev. Lett. **64**, 1843 (1990).
17. R. C. Ball and R. Blumenfeld
Universal scaling of the stress field at the vicinity of a wedge crack in two dimensions and oscillatory self-similar corrections to scaling, Phys. Rev. Lett. **65**, 1784-1787 (1990).
16. R. Blumenfeld
Phase coherence oscillation of holes in $La_{2-x}Sr_xCuO_4$, dynamics of single holes in the CuO plane and the typical pairing time, Physica **A 168**, 705-713 (1990); (Erratum) Physica **A 180**, 462 (1991).
15. R. Blumenfeld
Novel flux solutions in nonlinear continuum systems with negative dynamic resistance, Physica **A 168**, 697-704 (1990).
14. O. Entin-Wohlman, U. Sivan, R. Blumenfeld and Y. Meir
Dynamic structure factor of fractals, Physica **D 38**, 93-97 (1989).
13. R. Blumenfeld and D. J. Bergman
Exact calculation to second order of the effective dielectric constant of a strongly nonlinear composite, Phys. Rev. **B 40**, (Rapid Comm.) 1987-1989 (1989).
12. R. Blumenfeld
Universality and superuniversality of multifractals in nonlinear networks, J. Stat. Phys. **56**, 233-241 (1989).
11. R. Blumenfeld and A. Aharony
Breakdown of multifractal behaviour in diffusion limited aggregates, Phys. Rev. Lett. **62**, 2977-2980 (1989).
10. R. Blumenfeld and D. J. Bergman
Nonlinear dielectrics: electrostatics of random media and propagation of waves in a homogeneous slab, Physica **A 157**, 428-436 (1989).
9. A. Aharony, R. Blumenfeld, P. Breton, B. Fourcade, A. B. Harris, Y. Meir and A. -M. S. Tremblay
Negative moments of currents in percolating resistor networks, Phys. Rev. **B 40**, (Brief Report) 7318 (1989).
8. U. Sivan, R. Blumenfeld, Y. Meir and O. Entin-Wohlman
Dynamic structure factor of a deterministic fractal, Europhys. Lett. **7**, 249-253 (1988).
7. R. Blumenfeld

Probability densities of homogeneous functions: Explicit approximation and applications to percolating networks, J. Phys. A: Math. Gen. **21**, 815-825 (1988).

6. Y. Meir, R. Blumenfeld, A. B. Harris and A. Aharony
Series analysis of randomly diluted nonlinear networks with negative nonlinearity exponent, Phys. Rev. **B 36**, 3950-3952 (1987).
5. R. Blumenfeld and D. J. Bergman
Fluid flow in a random porous medium: A network model and effective medium approximation, J. Appl. Phys. **62**, 1616-1621 (1987).
4. R. Blumenfeld, Y. Meir, A. Aharony and A. B. Harris
Resistance fluctuations in randomly diluted networks, Phys. Rev. **B 35**, 3524-3535 (1987).
3. Y. Meir, R. Blumenfeld, A. Aharony and A. B. Harris
Series analysis of randomly diluted nonlinear resistor networks, Phys. Rev. **B 34**, 3424-3428 (1986).
2. R. Blumenfeld, Y. Meir, A. B. Harris and A. Aharony
Infinite set of exponents describing physics on fractal networks, J. Phys. A: Math. Gen. **19**, L791-L796 (1986).
1. R. Blumenfeld and A. Aharony
Nonlinear resistor fractal networks, topological distances, singly connected bonds and fluctuations, J. Phys. A: Math. Gen. **18**, L443-L448 (1985).

II. Refereed contributions to symposia and compiled volumes

1. R. Blumenfeld and A. Aharony
Nolinear resistor fractal networks in Scaling phenomena in disordered systems, Eds. R. Pynn and A Skjeltorp (Plenum, 1985).
2. R. Blumenfeld and R. C. Ball
Universally correlated scale-invariant sidebranching in propagation of a two-dimensional cracking growth in Correlations and connectivity, Eds. H. E. Stanley and N. Ostrowsky (Kluwer Academic Publishers, Dordrecht, 1990) pp. 313-316.
3. G. Corsten, C. Liem, R. Blumenfeld, N. Jan and C. Bowen
Vortex-antivortex pairing of holes in frustrated XY spin systems in Correlations and connectivity, Eds. H. E. Stanley and N. Ostrowsky (Kluwer Academic Publishers, Dordrecht, 1990) pp. 121-130.
4. R. C. Ball and R. Blumenfeld
Universal scaling of the stress field generated by a two dimensional wedge crack and periodic self-similar corrections to scaling in Proceedings of the EPS-8 meeting "Trends in Physics", Ed. F. Pleiter (1990).
5. R. Blumenfeld, N. Jan, G. Corsten and C. Liem
Evidence for vortex/antivortex mediated pairing of holes in doped $La_{2-x}Sr_xCuO_4$ and a possible mechanism for the holes movement in Proceedings of the EPS-8 meeting "Trends in Physics", Ed. F. Pleiter (1990).
6. R. Blumenfeld
Novel flux solutions in nonlinear conducting continuum systems with negative dynamic resistance in Proceedings of the EPS-8 meeting "Trends in Physics", Ed. F. Pleiter (1990).
7. R. Blumenfeld
Towards a theory of growing surfaces: Mapping Laplacian growth onto Hamiltonian dynamics and statistics in Fluctuations and Order: The New Synthesis, Ed. M. M. Millonas (Springer-Verlag, 1995); cond-mat/9401069.
8. R. Blumenfeld
A morphological theory for Laplacian nonlinear growth processes via statistics of equivalent many-body systems in Nonlinear Evolution Equations and Dynamical Systems (NEEDS94), Eds. V.G. Makhankov, A.R. Bishop, and D.D. Holm (World Scientific, 1995).
9. R. Blumenfeld
A theory for the morphology of Laplacian growths from statistics of equivalent many-body systems in Fractal Reviews in the Natural and Applied Sciences, Ed. M.M. Novak (Chapman-Hill, 1995).
10. R. Blumenfeld

A theory for growing interfaces in Laplacian fields: a many-body formulation and statistical analysis in 1994 MRS General Meeting, Boston, MA, USA.

11. R. Blumenfeld and Robin C. Ball
Characterization of fractal and hierarchical morphologies beyond the fractal dimension in 1995 MRS General Meeting, Boston, MA, USA.
12. S. Zhou, R. Blumenfeld, B. Holian and P. S. Lomdahl
Study of fiber composite failure criterion in 1996 MRS Proceedings **V409** *Fracture-instability dynamics, scaling, and ductile/brittle behavior*, Eds. R. L. Blumberg Selinger et al..
13. A. E. Garcia, R. Blumenfeld, G. Hummer and J. Sobehart
Diffusion of a protein in configuration space in Proceedings of the 9th Conversation in Biomolecular Stereodynamics, Eds. R.H. Sarma and M.H. Sarma (Adenine Press, Schenectady, NY 1996).
14. R. Blumenfeld
Dynamics of fracture propagation in the mesoscale: Theory MESOMECHANICS98, Tel Aviv, Israel.
15. R. Blumenfeld,
Dynamics of twists on antiferromagnetic spin chains: Theory, International conference on geometry, nonlinearity, and integrability in condensed matter and soft condensed matter physics, Bansko, Bulgaria.

III. In preparation

(a): Granular, colloidal, and cellular systems

1. R. Blumenfeld
Entropy and stress transmission in cellular systems: Two faces of the same tensor.
2. R. C. Ball and R. Blumenfeld
New equations for plastic yield of granular media.
3. R. Blumenfeld
Cellular systems: A new state of solid matter?.
4. R. Blumenfeld
Marginally rigid state in compliant granular packings.

(b): Pullout and dynamics of long molecules and disentanglement

1. R. Blumenfeld,
Hysteretic force response in pullout of long molecules
2. R. Blumenfeld
Disentaglement dynamics and applications to deformations in polymer glasses and interfaces.

(c): Magnetic and stagger-ordered systems

1. R. Blumenfeld and Avadh Saxena
Exact multi-twist solutions for Heisenberg spins on elastically deformable cylinders.
2. R. Blumenfeld and A. B. Saxena
Wrinkling and magneto-active control in single-wall carbon nanotubes.
3. R. Blumenfeld
Position dependent velocities of twists along inhomogeneous antiferromagnetic Heisenberg spin chains.
4. R. Blumenfeld and J. Sobehart
The classical antiferromagnetic Heisenberg chain: Novel exact dynamical solutions and an undelying broad symmetry.

(d): Miscellaneous

1. S. J. Zhou and R. Blumenfeld
On failure of fiber composites: Growth vs. nucleation.
2. R. Blumenfeld
An algorithm for the minimal path length in random networks using variational analysis.

Selected publications

* R. C. Ball and R. Blumenfeld, *The stress field in granular systems: Loop forces and potential formulation*, Phys. Rev. Lett., **88**, 115505 (2002).
* R. Blumenfeld, S. F. Edwards and R. C. Ball, *Granular matter and the marginal rigidity state*, Nature, submitted; cond-mat/0105348.
* R. Blumenfeld and S. F. Edwards, *Granular entropy: Explicit calculations for planar assemblies*, Phys. Rev. Lett. **90**, 114303 (2003).
* R. Blumenfeld, *Stress transmission in planar disordered solid foams*, J. Phys. A: Math. Gen. **36**, 2399-2411 (2003).
* R. Blumenfeld and Benoit B. Mandelbrot, *Mass fractal lacunarity, Lévy dusts, Mittag-Leffler statistics, and perceived dimension*, Phys. Rev. **E 56**, 112 (1997).
* R. Blumenfeld, *Planar curve representation of many-body systems and dynamics* Phys. Rev. Lett., **78**, 1203 (1997).
* B. L. Holian, R. Blumenfeld and P. Gumbsch, *An Einstein model of brittle crack propagation*, Phys. Rev. Lett. **78**, 78 (1997).
* R. Blumenfeld, *Nonequilibrium brittle fracture propagation: Steady state, oscillations and intermittency*, Phys. Rev. Lett. **76**, 3703 (1996).