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## Travelling waves on trees and square lattices

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## BIBLIOGRAPHY

- [1] Samuel M. Allen and John W. Cahn. A microscopic theory for antiphase boundary motion and its application to antiphase domain coarsening. *Acta Metallurgica*, 27(6):1085 – 1095, 1979.
- [2] Donald E Amos. Computation of modified bessel functions and their ratios. *Mathematics of Computation*, 28(125):239–251, 1974.
- [3] Alex Arenas, Albert Díaz-Guilera, and Roger Guimera. Communication in networks with hierarchical branching. *Physical review letters*, 86(14):3196, 2001.
- [4] D. G. Aronson and Hans F. Weinberger. Nonlinear diffusion in population genetics, combustion, and nerve pulse propagation. 1975.
- [5] Donald G Aronson and Hans F Weinberger. Multidimensional nonlinear diffusion arising in population genetics. *Advances in Mathematics*, 30(1):33–76, 1978.
- [6] Markus Bär, Martin Falcke, Herbert Levine, and Lev S Tsimring. Discrete stochastic modeling of calcium channel dynamics. *Physical Review Letters*, 84(24):5664, 2000.
- [7] IV Barashenkov, OF Oxtoby, and Dmitry E Pelinovsky. Translationally invariant discrete kinks from one-dimensional maps. *Physical Review E*, 72(3):035602, 2005.
- [8] Peter W. Bates, Xinfu Chen, and Adam J. J. Chmaj. Traveling waves of bistable dynamics on a lattice. *SIAM J. Math. Anal.*, 35(2):520–546, 2003.
- [9] Peter W Bates and Adam Chmaj. A discrete convolution model for phase transitions. *Archive for Rational Mechanics and Analysis*, 150(4):281–368, 1999.
- [10] M. Beck, B. Sandstede, and K. Zumbrun. Nonlinear stability of time-periodic viscous shocks. *Archive for rational mechanics and analysis*, 196(3):1011–1076, 2010.
- [11] Jonathan Bell. Some threshold results for models of myelinated nerves. *Mathematical Biosciences*, 54(3-4):181–190, 1981.

- [12] Jonathan Bell and Chris Cosner. Threshold behavior and propagation for non-linear differential-difference systems motivated by modeling myelinated axons. *Quarterly of Applied Mathematics*, 42(1):1–14, 1984.
- [13] Henri Berestycki and François Hamel. Generalized travelling waves for reaction-diffusion equations. *Contemporary Mathematics*, 446:101–124, 2007.
- [14] Henri Berestycki, Hiroshi Matano, and François Hamel. Bistable traveling waves around an obstacle. *Communications on Pure and Applied Mathematics: A Journal Issued by the Courant Institute of Mathematical Sciences*, 62(6):729–788, 2009.
- [15] John W Cahn. Theory of crystal growth and interface motion in crystalline materials. *Acta metallurgica*, 8(8):554–562, 1960.
- [16] John W. Cahn, John Mallet-Paret, and Erik S. Van Vleck. Traveling wave solutions for systems of ODEs on a two-dimensional spatial lattice. *SIAM J. Appl. Math.*, 59(2):455–493, 1999.
- [17] A Carpio, LL Bonilla, and G Dell’Acqua. Motion of wave fronts in semiconductor superlattices. *Physical Review E*, 64(3):036204, 2001.
- [18] Raphaël Cerf. *The Wulff Crystal in Ising and Percolation Models: Ecole D’Eté de Probabilités de Saint-Flour XXXIV-2004*. Springer, 2006.
- [19] Seok-Ho Chang, Pamela C Cosman, and Laurence B Milstein. Chernoff-type bounds for the gaussian error function. *IEEE Transactions on Communications*, 59(11):2939–2944, 2011.
- [20] X. Chen, J. S. Guo, and C. C. Wu. Traveling Waves in Discrete Periodic Media for Bistable Dynamics. *Arch. Ration. Mech. Anal.*, 189:189–236, 2008.
- [21] Marco Chiani and Davide Dardari. Improved exponential bounds and approximation for the q-function with application to average error probability computation. In *Global Telecommunications Conference, 2002. GLOBECOM’02. IEEE*, volume 2, pages 1399–1402. IEEE, 2002.
- [22] S-N Chow and John Mallet-Paret. Pattern formation and spatial chaos in lattice dynamical systems. i. *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications*, 42(10):746–751, 1995.
- [23] Shui-Nee Chow, John Mallet-Paret, and Wenxian Shen. Traveling waves in lattice dynamical systems. *J. Differential Equations*, 149(2):248–291, 1998.
- [24] Shui-Nee Chow, John Mallet-Paret, and Erik S Van Vleck. Dynamics of lattice differential equations. *International Journal of Bifurcation and Chaos*, 6(09):1605–1621, 1996.
- [25] H. Cook, D. D. Fontaine, and J. E. Hilliard. A model for diffusion on cubic lattices and its application to the early stages of ordering. *Acta Metallurgica*, 17:765–773, 1969.

- [26] Keenan Crane. Discrete differential geometry: An applied introduction. *Notices of the AMS, Communication*, pages 1153–1159, 2018.
- [27] Klaus Deckelnick, Gerhard Dziuk, and Charles M Elliott. Computation of geometric partial differential equations and mean curvature flow. *Acta numerica*, 14:139–232, 2005.
- [28] Persi Diaconis and Laurent Saloff-Coste. Convolution powers of complex functions on. *Mathematische Nachrichten*, 287(10):1106–1130, 2014.
- [29] Weiwei Ding and Thomas Giletti. Admissible speeds in spatially periodic bistable reaction-diffusion equations. *arXiv preprint arXiv:2006.05118*, 2020.
- [30] S. V. Dmitriev, P. G. Kevrekidis, and N. Yoshikawa. Discrete Klein–Gordon Models with Static Kinks Free of the Peierls–Nabarro Potential. *J. Phys. A.*, 38:7617–7627, 2005.
- [31] A. Erdős, P.; Rényi. On random graphs i. *Publ. Math. Debrecen*, 6:290–297, 1959.
- [32] Paul C Fife. Long time behavior of solutions of bistable nonlinear diffusion equations. *Archive for Rational Mechanics and Analysis*, 70(1):31–36, 1979.
- [33] Paul C Fife. *Mathematical aspects of reacting and diffusing systems*, volume 28. Springer Science & Business Media, 2013.
- [34] Paul C Fife and J Bryce McLeod. The approach of solutions of nonlinear diffusion equations to travelling front solutions. *Archive for Rational Mechanics and Analysis*, 65(4):335–361, 1977.
- [35] Ronald Aylmer Fisher. The wave of advance of advantageous genes. *Annals of eugenics*, 7(4):355–369, 1937.
- [36] Thierry Gallay, Emmanuel Risler, et al. A variational proof of global stability for bistable travelling waves. *Differential and integral equations*, 20(8):901–926, 2007.
- [37] G.N.Watson. *A Treatise On The Theory of Bessel Functions*. Merchant Books, 1922.
- [38] Jong-Shenq Guo and François Hamel. Front propagation for discrete periodic monostable equations. *Mathematische Annalen*, 335(3):489–525, 2006.
- [39] D. Hankerson and B. Zinner. Wavefronts for a cooperative tridiagonal system of differential equations. *Journal of Dynamics and Differential Equations*, 5(2):359–373, Apr 1993.
- [40] Mariana Haragus and Arnd Scheel. Almost Planar Waves in Anisotropic Media. *Communications in Partial Differential Equations*, 31(5):791–815, 2006.
- [41] Dana Hobson. An efficient method for computing invariant manifolds of planar maps. *Journal of Computational Physics*, 104(1):14–22, 1993.

- [42] Aaron Hoffman and Matt Holzer. Invasion fronts on graphs: The fisher-kpp equation on homogeneous trees and erdős-rényi graphs. *Discrete & Continuous Dynamical Systems - B*, 24(2):671–694, 2019.
- [43] Aaron Hoffman, H Hupkes, and E Van Vleck. Multi-dimensional stability of waves travelling through rectangular lattices in rational directions. *Transactions of the American Mathematical Society*, 367(12):8757–8808, 2015.
- [44] Aaron Hoffman, Hermen Hupkes, and E Van Vleck. *Entire solutions for bistable lattice differential equations with obstacles*, volume 250. American Mathematical Society, 2017.
- [45] Aaron Hoffman and John Mallet-Paret. Universality of crystallographic pinning. *J. Dynam. Differential Equations*, 22(2):79–119, 2010.
- [46] Aaron Hoffman and John Mallet-Paret. Universality of crystallographic pinning. *Journal of Dynamics and Differential Equations*, 22(2):79–119, 2010.
- [47] H Hupkes, D Pelinovsky, and Björn Sandstede. Propagation failure in the discrete nagumo equation. *Proceedings of the American Mathematical Society*, 139(10):3537–3551, 2011.
- [48] H. J. Hupkes and B. Sandstede. Stability of pulse solutions for the discrete FitzHugh-Nagumo system. *Trans. Amer. Math. Soc.*, 365(1):251–301, 2013.
- [49] Hermen Jan Hupkes and Leonardo Morelli. Travelling corners for spatially discrete reaction-diffusion system. *Communications on Pure and Applied Analysis*, 2019.
- [50] Hermen Jan Hupkes, Leonardo Morelli, Willem M Schouten-Straatman, and Erik S Van Vleck. Traveling waves and pattern formation for spatially discrete bistable reaction-diffusion equations. In *International Conference on Difference Equations and Applications*, pages 55–112. Springer, 2018.
- [51] Christopher KRT Jones. Spherically symmetric solutions of a reaction-diffusion equation. *Journal of Differential Equations*, 49(1):142–169, 1983.
- [52] Mia Jukić and Hermen Jan Hupkes. Dynamics of curved travelling fronts for the discrete allen-cahn equation on a two-dimensional lattice. *Discrete & Continuous Dynamical Systems-A*, 2019.
- [53] Mia Jukic and Hermen Jan Hupkes. Curvature-driven front propagation through planar lattices in oblique directions. *Communications on Pure & Applied Analysis*, 2022.
- [54] Todd Kapitula. Multidimensional stability of planar travelling waves. *Transactions of the American Mathematical Society*, 349(1):257–269, 1997.
- [55] James P Keener. Propagation and its failure in coupled systems of discrete excitable cells. *SIAM Journal on Applied Mathematics*, 47(3):556–572, 1987.

- [56] James P Keener. The effects of discrete gap junction coupling on propagation in myocardium. *Journal of theoretical biology*, 148(1):49–82, 1991.
- [57] James P Keener and James Sneyd. *Mathematical physiology*, volume 1. Springer, 1998.
- [58] Timothy H Keitt, Mark A Lewis, and Robert D Holt. Allee effects, invasion pinning, and species' borders. *The American Naturalist*, 157(2):203–216, 2001.
- [59] William Ogilvy Kermack and Anderson G McKendrick. A contribution to the mathematical theory of epidemics. *Proceedings of the royal society of london. Series A, Containing papers of a mathematical and physical character*, 115(772):700–721, 1927.
- [60] Panayotis G Kevrekidis. Non-linear waves in lattices: past, present, future. *IMA Journal of Applied Mathematics*, 76(3):389–423, 2011.
- [61] Hiroshi Kori and Alexander S. Mikhailov. Strong effects of network architecture in the entrainment of coupled oscillator systems. *Physical Review E*, 74(6):066115, dec 2006.
- [62] Nikos E. Kouvaris, Hiroshi Kori, and Alexander S. Mikhailov. Traveling and pinned fronts in bistable reaction-diffusion systems on networks. *PLoS ONE*, 7(9):e45029, sep 2012.
- [63] C. D. Levermore and J. X. Xin. Multidimensional Stability of Travelling Waves in a Bistable Reaction-Diffusion Equation, II. *Comm. PDE*, 17:1901–1924, 1992.
- [64] Simon A Levin. Population dynamic models in heterogeneous environments. *Annual review of ecology and systematics*, 7(1):287–310, 1976.
- [65] J. Mallet-Paret. *Crystallographic Pinning: Direction Dependent Pinning in Lattice Differential Equations*. Citeseer, 2001.
- [66] John Mallet-Paret. The fredholm alternative for functional differential equations of mixed type. *Journal of Dynamics and Differential Equations*, 11(1):1–47, Jan 1999.
- [67] John Mallet-Paret. The global structure of traveling waves in spatially discrete dynamical systems. *Journal of Dynamics and Differential Equations*, 11(1):49–127, 1999.
- [68] Hiroshi Matano, Yoichiro Mori, and Mitsunori Nara. Asymptotic behavior of spreading fronts in the anisotropic allen–cahn equation on rn. In *Annales de l'Institut Henri Poincaré C, Analyse non linéaire*, volume 36, pages 585–626. Elsevier, 2019.
- [69] Hiroshi Matano and Mitsunori Nara. Large time behavior of disturbed planar fronts in the allen–cahn equation. *Journal of Differential Equations*, 251(12):3522–3557, 2011.

- [70] Roeland MH Merks, Yves Van de Peer, Dirk Inzé, and Gerrit TS Beemster. Canalization without flux sensors: a traveling-wave hypothesis. *Trends in plant science*, 12(9):384–390, 2007.
- [71] Jurgen Moser. *Stable and random motions in dynamical systems*. Princeton university press, 2016.
- [72] J. Nagumo, S. Arimoto, and S. Yoshizawa. An active pulse transmission line simulating nerve axon. *Proceedings of the IRE*, 50(10):2061–2070, 1962.
- [73] Edward Neuman. Inequalities involving modified bessel functions of the first kind. *Journal of mathematical analysis and applications*, 171(2):532–536, 1992.
- [74] Stanley Osher and Barry Merriman. The wulff shape as the asymptotic limit of a growing crystalline interface. *Asian Journal of Mathematics*, 1(3):560–571, 1997.
- [75] B. V. Pal'tsev. Two-sided bounds uniform in the real argument and the index for modified bessel functions. *Mathematical Notes*, 65(5):571–581, May 1999.
- [76] W.-X. Qin and X. Xiao. Homoclinic Orbits and Localized Solutions in Nonlinear Schrödinger Lattices. *Nonlinearity*, 20:2305–2317, 2007.
- [77] Evan Randles and Laurent Saloff-Coste. On the convolution powers of complex functions on  $\mathbb{Z}$ . *Journal of Fourier Analysis and Applications*, 21(4):754–798, 2015.
- [78] Emmanuel Risler. Global convergence toward traveling fronts in nonlinear parabolic systems with a gradient structure. In *Annales de l'Institut Henri Poincaré (C) Non Linear Analysis*, volume 25, pages 381–424. Elsevier, 2008.
- [79] Violaine Roussier. Stability of radially symmetric travelling waves in reaction–diffusion equations. In *Annales de l'Institut Henri Poincaré (C) Non Linear Analysis*, volume 21, pages 341–379. Elsevier, 2004.
- [80] J. F. F. Mendes S. N. Dorogovtsev. *Evolution of Networks: From Biological Nets to the Internet and WWW*. OXFORD UNIV PR, January 2014.
- [81] DH Sattinger. Weighted norms for the stability of traveling waves. *Journal of Differential Equations*, 25(1):130–144, 1977.
- [82] W. M. Schouten-Straatman and H. J. Hupkes. Nonlinear Stability of Pulse Solutions for the Discrete Fitzhugh-Nagumo equation with Infinite-Range Interactions. *Discrete and Continuous Dynamical Systems A*, 39(9), 2019.
- [83] Fanni Sélley, Ádám Besenyei, Istvan Z. Kiss, and Péter L. Simon. Dynamic control of modern, network-based epidemic models. *SIAM J. Appl. Dyn. Syst.*, 14(1):168–187, 2015.
- [84] Antonín Slavík. Lotka-Volterra competition model on graphs. *SIAM J. Appl. Dyn. Syst.*, 19(2):725–762, 2020.

- [85] R. P. Soni. On an inequality for modified bessel functions. *Journal of Mathematics and Physics*, 44(1-4):406–407, 1965.
- [86] P. Stehlík. Exponential number of stationary solutions for Nagumo equations on graphs. *J. Math. Anal. Appl.*, 455(2):1749–1764, 2017.
- [87] Gui-Quan Sun. Mathematical modeling of population dynamics with allee effect. *Nonlinear Dynamics*, 85(1):1–12, Jul 2016.
- [88] Caz M Taylor and Alan Hastings. Allee effects in biological invasions. *Ecology Letters*, 8(8):895–908, 2005.
- [89] Kōhei Uchiyama. Asymptotic behavior of solutions of reaction-diffusion equations with varying drift coefficients. *Archive for Rational Mechanics and Analysis*, 90(4):291–311, 1985.
- [90] Remco Van Der Hofstad. *Random Graphs and Complex Networks: Volume 1*, volume 43. Cambridge university press, 2016.
- [91] B. van Hal. Travelling Waves in Discrete Spatial Domains. *Bachelor Thesis*, 2017.
- [92] Pierre-François Verhulst. Notice sur la loi que la population suit dans son accroissement. *Corresp. Math. Phys.*, 10:113–126, 1838.
- [93] G Wul. Achen on the question of the speed of growth and dissolution of the crystal. *Z. Crystallogr.*, 34:449–530, 1901.
- [94] J. X. Xin. Multidimensional Stability of Travelling Waves in a Bistable Reaction-Diffusion Equation, I. *Comm. PDE*, 17:1889–1900, 1992.
- [95] Huihui Zeng. Stability of planar travelling waves for bistable reaction–diffusion equations in multiple dimensions. *Applicable Analysis*, 93(3):653–664, 2014.
- [96] Bertram Zinner. Stability of traveling wavefronts for the discrete nagumo equation. *SIAM journal on mathematical analysis*, 22(4):1016–1020, 1991.
- [97] Bertram Zinner. Existence of traveling wavefront solutions for the discrete nagumo equation. *Journal of differential equations*, 96(1):1–27, 1992.



