

Curriculum Vitae

Nour Eddine Alaa

Faculty of Science and Technology
University Cadi Ayyad
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Professional qualifications and scientific degree:

2000 Full Professor, Cadi Ayyad University
1996 Dr. Habilitation, University Cadi Ayyad
1992 Assistant Professor, University Cadi Ayyad
1989 PhD University of Henri Poincare, France
1986 MSc in Applied Mathematics, University of Henri Poincare, France

Job, position:

2006 -2012 Professor, director of LAMAI Laboratory, University of Cadi Ayyad
2012-2014 Professor, Director of mathematics Department, FST, Marrakesh

Research area:

Data Science, Intelligence Artificial, Shape optimization, Mathematical modelling and simulation by finite element method, Pattern formation, Image processing, Neural Network, Genetic Algorithm, Metaheuristics methods.

Non-academic activities:

Vice-President of A2MIM Association since 2016

Leadership in international research projects:

1996-2000 Director (on the Moroccan side) of the Project : Action Intégrée MA/1996/1039 between University Cadi Ayyad and University Henri Poincare of Nancy, France.
2002-2006 Director (on the Moroccan side) of the Project : Action Intégrée MA/02/33 between University Cadi Ayyad and University Henri Poincare of Nancy, France.
2007-2011 Director (on the Moroccan side) of the Project : Action Intégrée MA/07/164 between University Cadi Ayyad and University Henri Poincare of Nancy, France.
2019-2025 Expert Évaluateur au près du CNRST et UM6P

Publications(last 5 years):

- 1) Mathematical analysis and numerical simulation of a strongly nonlinear singular model, M Hourri, L Taourirte, NE Alaa, Annals of the University of Craiova-Mathematics and Computer Science Series, Volume 50(2), 2023, Pages 325–341, DOI: 10.52846/ami.v50i2.1697
- 2) A Charkaoui, NE Alaa, An $p(x)$ -theory for a nonlinear temporal periodic problem involving $p(x)$ -growth structure with a strong dependence on gradients, Journal of Evolution Equations 23 (4), 73, 2023.
- 3) Alaa, N.E., Charkaoui, A., El Ghabi, M. *et al.* Integral Solution for a Parabolic Equation Driven by the $p(x)$ -Laplacian Operator with Nonlinear Boundary Conditions and L Data. *Mediterr. J. Math.* **20**, 244 (2023). <https://doi.org/10.1007/s00009-023-02446-7>
- 4) Nokrane, A., Alaa, N.E. & Aqel, F. Fourth-order nonlinear degenerate problem for image decomposition. *Partial Differ. Equ. Appl.* **4**, 31 (2023). <https://doi.org/10.1007/s42985-023-00251-1>
- 5) Alaa, N.E., Aqel, F. & Nokrane, A. Parabolic equation driven by general differential operators with variable exponents and degenerate nonlinearities: Application to image restoration. *Comp. Appl. Math.* **42**, 233 (2023). <https://doi.org/10.1007/s40314-023-02371-1>
- 6) Aqel, F. Alaa, H; Alaa, N. E., MATHEMATICAL MODEL OF COVID-19 TRANSMISSIBILITY DURING THE VACCINATION PERIOD, *Eurasian Journal of Mathematical and Computer Applications* ; 11(1):4-28, 2023.
- 7) El Alaoui El Fels, A., Alaa, N., Bachnou, A. *et al.* Frequency analysis of extreme flows using an Artificial Neural Network (ANN) model case Western High Atlas - Morocco. *Earth Sci Inform* **15**, 965–978 (2022). <https://doi.org/10.1007/s12145-022-00784-w>

- 8) Maryem Hourri, Nouredine Alaa, Hybridization of Neural Networks and Sine Cosine Algorithm for an Optimal Neural Network Architecture Applied to Prevent Heart Attacks, iJOE – Vol. 18, No. 05, 2022
- 9) Charkaoui, A., Alaa, N.E. Nonnegative weak solution for a periodic parabolic equation with bounded Radon measure. *Rend. Circ. Mat. Palermo, II. Ser* **71**, 459–467 (2022). <https://doi.org/10.1007/s12215-021-00614-w>
- 10) Fahim H., Sawadogo O.W., Alaa N., Guedda M., AN EFFICIENT IDENTIFICATION OF RED BLOOD CELL EQUILIBRIUM SHAPE USING NEURAL NETWORKS, EURASIAN JOURNAL OF MATHEMATICAL AND COMPUTER APPLICATIONS ISSN 2306–6172 Volume 9, Issue 2 (2021) 39 – 56
- 11) Alaa, N., Alaa, K., Atounti, M., Aqel, F, A new mathematical model for contrast enhancement in digital images. *Mathematical Modeling and Computing*, (Vol. 9, Num. 2), 342–350, (2022).
- 12) A. Charkaoui, N.E. Alaa, Existence and uniqueness of renormalized periodic solution to a nonlinear parabolic problem with variable exponent and L^1 data, *Journal of Mathematical Analysis and Applications*, Volume 506, Issue 2, 15 February 2022, 125674.
- 13) H Alaa, NE Alaa, F Aqel, H Lefraich , A new Lattice Boltzmann method for a Gray–Scott based model applied to image restoration and contrast enhancement, *Math Model Comput*, Vol. 9, Numéro 2 Pages 187-202, 2022
- 14) F Aqel, K Alaa, N Alaa, M Atounti, Hybridization of Divide-and-Conquer technique and Neural Network algorithm for better contrast enhancement in medical images. *Mathematical Modeling and Computing*, (Vol. 9, Num. 4), 921-935 (2022)
- 15) F Aqel, L Taourirte, NE Alaa, Global existence of weak solutions to a Keller-Segel model with initial data, *ANNALI DELL'UNIVERSITA'DI FERRARA* 69 (1), 59-79 (2022).
- 16) Aqel F., Alaa H., Alaa N. E., MATHEMATICAL MODEL OF COVID-19 TRANSMISSIBILITY DURING THE VACCINATION PERIOD, EURASIAN JOURNAL OF MATHEMATICAL AND COMPUTER APPLICATIONS 11 (1), 4 –28 (2022).
- 17) I El Malki, NE Alaa , Mathematical study for an electrodeposition model using the topological degree, , *Discrete and Continuous Dynamical Systems-S*, 2022.
- 18) NE Alaa, A Charkaoui, A Elaassri, *Proyecciones* , Periodic parabolic problem with discontinuous coefficients: Mathematical analysis and numerical simulation, (*Antofagasta*) 41 (6), 1251-1271(2022)
- 19) H Alaa, NE Alaa, A Bouchriti, A CHARKAOUI, An improved nonlinear anisotropic PDE with $p(x)$ -growth conditions applied to image restoration and enhancement to appear in *MMA* (2024)
- 20) Alaa, H. Alaa, N. E. F. Aqel, Development and simulation of a mathematical model to simulate the phase transmissibility of covid19 in Morocco, *Annals of the University of Craiova, Mathematics and Computer Science Series* Volume 49(1), 2022, Pages 75–83
- 21) A El Alaoui El Fels, NE Alaa, A Bachnou, O El Barrimi, Frequency analysis of extreme flows using an Artificial Neural Network (ANN) model case Western High Atlas-Morocco, *Earth Science Informatics* 15 (2), 965-978
- 22) M Hourri, N Alaa, *International Journal of Online & Biomedical Engineering* 18 (5)
- 23) Nonnegative weak solution for a periodic parabolic equation with bounded Radon measure, A Charkaoui, NE Alaa, *Rendiconti del Circolo Matematico di Palermo Series 2* 71 (1), 459-467
- 24) H Fahim, OW Sawadogo, N Alaa, An efficient identification of red blood cell equilibrium shape using neural networks, M Guedda, *Eurasian Journal of Mathematical and Computer Applications* 9 (2), 39-56(2021)
- 25) M Atounti, F Aqel, NE Alaa, A new mathematical model for contrast enhancement in digital images, *Mathematical Modeling and computing* 9 (2), 342–350 (2021)
- 26) A Charkaoui, NE Alaa, Existence and uniqueness of renormalized periodic solution to a nonlinear parabolic problem with variable exponent and L^1 data, , *Journal of Mathematical Analysis and Applications* 506 (2), 125674 (2021)
- 27) H Alaa, NE Alaa, F Aqel, H Lefraich , A new Lattice Boltzmann method for a Gray–Scott based model applied to image restoration and contrast enhancement, *Math Model Comput*, Vol. 9, Numéro 2 Pages 187-202, 2022
- 28) Laila Taourirte, Nour Eddine Alaa, and Hamza Khalfi, Improved GWO algorithm for the determination of the critical wrinkle length of graphene, *Annals of the University of Craiova, Mathematics and Computer Science Series* Volume 46(1), 2019, Pages 27–40
- 29) Ihsane Mouaouia, W. Olivier Sawadogo, Abderrahim Charkaoui, and Nour Eddine Alaa, Mathematical modelling of nitrogen removal in horizontal subsurface flow constructed wetland, *Annals of the University of Craiova, Mathematics and Computer Science Series* Volume 46(1), 2019, Pages 41–55
- 30) Abdelwahab Elaassri, Kaoutar Lamrini Uahabi, Abderrahim Charkaoui, Nour Eddine Alaa, and Salim Mesbahi, Existence of weak periodic solution for quasilinear parabolic problem

- with nonlinear boundary conditions, *Annals of the University of Craiova, Mathematics and Computer Science Series Volume 46(1)*, 2019, Pages 1–13
- 31) Hamza Khalfi, Houda Fahim, and Nour Eddine Alaa, Mathematical analysis of a modified Weikert system for image enhancement, *Annals of the University of Craiova, Mathematics and Computer Science Series Volume 46(1)*, 2019, Pages 90–98
 - 32) Houda Fahim, Nour Eddine Alaa, and Chaouqi Misbah, Geometric shape optimization of membrane in the presence of a diffusion field, *Annals of the University of Craiova, Mathematics and Computer Science Series Volume 46(1)*, 2019, Pages 14–26
 - 33) A. Charkaoui, G Kouadri, O. Selt, Nour Eddine Alaa, *Annals of the University of Craiova-Mathematics*, Existence results of weak periodic solution for some quasilinear parabolic problem with L^1 data, *Annals of the University of Craiova, Mathematics and Computer Science Series Volume 46(1)*, 2019, Pages 66–77
 - 34) Hamid Lefraich, Laila Taourirte, Hamza Khalfi, and Nour Eddine Alaa, On the existence of global weak solutions to a generalized Keller Segel model with arbitrary growth and nonlinear signal production, *Annals of the University of Craiova, Mathematics and Computer Science Series Volume 46(1)*, 2019, Pages 99–108
 - 35) Saida Bendaas, Nouredine Alaa, Periodic Wave Shock Solutions of Burgers Equations, A New Approach, *Int. J. Nonlinear Anal. Appl.* (10) No. 1, 119–129
 - 36) Aqel, F., Alaa, N.E. Characterization of the Critical Value for a Quasilinear Elliptic Equation with Arbitrary Growth with Respect to the Gradient. *Mediterr. J. Math.* 16, 141 (2019).
 - 37) Anass Bouchriti, Morgan Pierre, and Nour Eddine Alaa, Simulation of the transmission line equation by a high-order FDTD method, *Annals of the University of Craiova, Mathematics and Computer Science Series Volume 46(2)*, 2019, Pages 410–42
 - 38) Hamza Khalfi Morgan Pierre, Nour Eddine Alaa and Mohammed Guedda, A Convergence to equilibrium of a DC algorithm for an epitaxial growth model, *INTERNATIONAL JOURNAL OF NUMERICAL ANALYSIS AND MODELING Computing and Information Volume 16, Number 3*, Pages 398–411(2019).
 - 39) Amal Aarab, Nour Eddine Alaa, Hamza Khalfi, Generic reaction-diffusion model with application to image restoration and enhancement, *Electron. J. Differential Equations*, Vol. 2018 (2018), No. 125, pp. 1-12.,
 - 40) A. Aarab, M. Guedda, Nour Eddine Alaa and C. Misbah, Mapping vesicle dynamics onto that of a rigid sphere in five dimensions, *Phys. Rev. E* 98, 042407 – Published 11 October 2018.
 - 41) El Fels, A. E. A., Nour Eddine Alaa., Bachnou, A., & Rachidi, S. (2018). Flood frequency analysis and generation of flood hazard indicator maps in a semi-arid environment, case of Ourika watershed (western High Atlas, Morocco). *Journal of African Earth Sciences*, Springer.
 - 42) El Fels, A. E. A., Bachnou, A., & Nour Eddine Alaa (2017). Combination of GIS and mathematical modeling to predict floods in semiarid areas: case of Rheraya watershed (Western High Atlas, Morocco). *Arabian Journal of Geosciences*, 10(24), 554.
 - 43) Boumenni, H., Bachnou, A., & Nour Eddine Alaa (2017). The rainfall-runoff model GR4J optimization of parameter by genetic algorithms and Gauss-Newton method: application for the watershed Ourika (High Atlas, Morocco). *Arabian Journal of Geosciences*, Springer, 10(15), 343.
 - 44) Allali, F., Nour Eddine Alaa., Ghammaz, A., & Rouijaa, H. (2017). Numerical Analysis of Transmission Lines Equation by new β -method Schemes. *Analele Universitatii "Ovidius" Constanta-Seria Matematica*, 25(2), 25-38.
 - 45) Nour Eddine Alaa & Aqel, F. (2017). Global existence of solutions for a system modelling electromigration of ions through biological cell membranes with L^1 data. *European Journal of Pure and Applied Mathematics*, 10(2), 272-294.
 - 46) Guedda, M., Nour Eddine Alaa & Benlahsen, M. (2016). Analytical results for the wrinkling of graphene on nanoparticles. *Physical Review E*, 94(4), 042806.
 - 47) Sawadogo, W. O., Nour Eddine Alaa Paré, Y., & Somé, B. (2016). Identification of the parameters of the equation of Richards by the genetic algorithms. *Advances in Theoretical and Applied Mathematics*, 11(1), 17-28.
 - 48) Nour Eddine Alaa., & Aqel, F. (2017). Existence of global solutions for reaction diffusion systems modeling the electrodeposition of alloys with initial data measures.

- Electronic Journal of Differential Equations, 2017(04), 1-15.
- 49) Mesbahi, S., & Nour Eddine Alaa (2015). Mathematical analysis of a reaction diffusion model for image restoration. Annals of the University of Craiova-Mathematics and Computer Science Series, 42(1), 70-79.
 - 50) Moida, A., & Nour Eddine Alaa (2015). Non-domination sorting genetic algorithm II for optimization of Priestley-Taylor transpiration parameters. Annals of the University of Craiova-Mathematics and Computer Science Series, 42(1), 3-12.
 - 51) Bouarifi, W., Nour Eddine Alaa, & Mesbahi, S. (2015). Global existence of weak solutions for parabolic triangular reaction. Annals of the University of Craiova-Mathematics and Computer Science Series, 42(1), 80-97.
 - 52) Moida, A., & Nour Eddine Alaa. (2015). Multi-objective generalised sensitivity analysis to TSEB model applied at irrigated olive orchard in semi-arid area. International Journal of Computational Science and Engineering, 11(2), 216-224.
 - 53) Alaa, N. E., Lefraich, H., & El Malki, I. (2014). A second-generation computational modeling of cardiac electrophysiology: response of action potential to ionic concentration changes and metabolic inhibition. Theoretical Biology and Medical Modelling, 11(1), 46.
 - 54) Alaa, N., Aitoussous, M., Bouarifi, W., & Bensikaddour, D. (2014). Image restoration using a reaction-diffusion process. Electronic Journal of Differential Equations, 2014(197), 1-12.
 - 55) Aqel, F., Alaa, N. E., & Lefraich, H. (2015). Periodic solution for some parabolic degenerate equation with critical growth with respect to the gradient. Annals of the University of Craiova-Mathematics and Computer Science Series, 42(1), 13-26.
 - 56) Oussous, M. A., Alaa, N., & Khouya, Y. A. (2013). Application of the gradient vector flow method for treating satellite image. Int. J. Comput. Sci. Issues, 10(4), 44-48.
 - 57) Alaa, N., & Lefraich, H. (2013). Computational simulation of a new system modelling ions electromigration through biological membranes. Theoretical Biology and Medical Modelling, 10(1), 51.
 - 58) Idhammad, A., Abdali, A., & Alaa, N. (2013). Computational simulation of the bone remodeling using the finite element method: an elastic-damage theory for small displacements. Theoretical Biology and Medical Modelling, 10(1), 32.
 - 59) Alaa, N. E., & Pierre, M. (2013). Convergence to equilibrium for discretized gradient-like systems with analytic features. IMA Journal of Numerical Analysis, 33(4), 1291-1321.
 - 60) Alaa, N., Fatmi, N. I., & Pierre, M. (2011). Quasilinear elliptic degenerated equations with nonlinearity in the gradient and L^1 data. International Journal of Mathematics and Statistics, 8, 62-69.

PhD supervision under my direction

- 1) Analyse mathématique d'une classe de Systèmes de Réactions Diffusion avec lois de balance, Thèse doctorat de l'université Cadi Ayyad par Ilhame Mounir 2000.
Currently Professeur at l'EST de Safi
- 2) Contribution à l'étude d'équations paraboliques périodiques avec données mesures, Thèse doctorat de l'université Cadi Ayyad par Mohammed Iguernane, 2001.
Currently Professeur Assistante en Arabi Saoudite
- 3) Systèmes et équations de réaction-diffusion :Modélisation, analyse mathématique et simulation numérique, Thèse doctorat de l'université chouaib doukkali par Nadia Idrissi FATMI, 2005.
Currently Professeur Assistant à l'ENSA de Khouribga
- 4) Assimilation de données des conditions initiales par contrôle optimal et identification de paramètres par algorithmes génétiques dans le modèle ICARE, Thèse doctorat de l'université Cadi Ayyad par Walid BOUAFIRI, 2009.
Currently Professeur Assistant à l'ENSA de Safi
- 5) "Contribution à l'approximation de problèmes d'identification et de décomposition de domaines en élasticité" Nature de la thèse : Habilitation Soutenue le 15 mars 2008, par Abdellatif Ellabib
Currently Professeur Habilité à la FST de Marrakech

- 6) " Développement d'un logiciel sous java pour la simulation numérique des processus de remodelage osseux" Nature de la thèse : Habilitation Soutenue le 4 novembre 2009 par Abdelmounaïm ABDALI
Currently Professeur Habilité à la FST de Marrakech
- 7) Analyse mathématique et simulation numérique des grandes fractures : Application au sahel de Burkina Fasso, Nature de la thèse : doctorat national, 2013, par Olivier SAWADO GUO
Currently Professeur Assistant à l'Université de Burkina Fasso.
- 8) "Modélisation de l'interface sol-végétation-atmosphère pour l'évaluation des risques d'incendie de forêts au Maroc," A. MOUIDA, Nature de la thèse, 28 Janvier 2014
Currently Professeur Ingénieur en chef à la Météo Nationale du Maroc
- 9) 'Contribution au traitement d'image par des processus de Réaction Diffusion", M. Ait OUSSOUS, Nature de la thèse : doctorat national, Université Cadi Ayyad soutenue le 28 Février 2014
- 10) "Reconnaissance de formes et applications en géologie", Y. AIT KHOUYA, Nature de la thèse : doctorat national, soutenue le 28 Février 2014.
- 11) " Analyse Mathématique de Systèmes de Reaction-Diffusion Quasi-linéaires avec Données non Régulières, S. Mesbahi, Nature de la thèse : doctorat national, Université Sétif 1, Algérie .
- 12) " Mathematical Analysis and numerical simulation of a system modeling electro diffusion reaction", par Hamid Lefraich, Nature de la thèse : doctorat national, soutenue le Samedi 20 Décembre 2014.
Currently Professeur at FST Settat Maroc
- 13) « Contibution to the mathematical analysis of a class of reaction diffusion systems with irregular data » par Fatima Aqel, Nature de la thèse : doctorat national, soutenue le Mardi 6 Mars 2018.
- 14) "Mathematical analysis and numerical simulation for a corrosion model in anisotropic domain" par Imane Elmalki, Nature de la thèse : doctorat national, soutenue le Vendredi 30 Décembre 2016.
- 15) « Texture Analysis of Images by Reaction-Diffusion Process" par Mariam Zirhem, Nature de la thèse : doctorat national, soutenue le Vendredi 11 Mai 2018.
- 16) "Mathematical and Numerical Analysis of some Growth Models in Biology and Physics, by Khalfi Hamza, soutenue le 28 Novembre 2018.
- 17) " Contribution to the mathematical analysis of the optimization and dynamics of vesicle shapes under complex flow" by Aarab Amal, soutenue le 28 Novembre 2018. Modélisation mathématiques et numérique d'un bio-réacteur de traitement des eaux usées, by Ihsane Mouaoui, soutenue en Décembre 2020
- 18) Contribution to the mathematical and numerical study of certain problems of biological membrane, magnetorheological fluid and image processing, by Houda Fahim, soutenue en Février 2021.
- 19) Mathematical and Numerical Analysis of the Wrinkling of Graphene, by Laila Taourite, soutenue en Décembre 2020.
- 20) Contribution to the mathematical and numerical analysis of some periodic parabolic problems with variables exponents and singular nonlinearities , by Abderrahim Charkaoui, soutenue en Décembre 2022.
- 21) Contribution to Risk Analysis and Biomathematical Models by Artificial Neural Networks, by Charafeddine Bailoul, soutenue en Décembre 2022.

