CONTACT INFORMATION

Physics and Engineering Mathematics Dept., Faculty of Engineering, Zagazig University, Sharkia, Egypt.

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PERSONAL

RABAB AHMED ALI ABOU SHANAB
Born in, AUG. 1st ,1988
Egyptian
Single

ACADEMIC POSITIONS

Associate Professor of Mathematics Permanent Position
Physics and Engineering Mathematics Dept., Faculty of Engineering, Zagazig University, Egypt — 2024-Present

Lecturer of Mathematics
Physics and Engineering Mathematics Dept., Faculty of Engineering, Zagazig University, Egypt — 2019-2024

Teaching Assistant
Physics and Engineering Mathematics Dept., Faculty of Engineering, Zagazig University, Egypt — 2014-2019

Teaching/ Demonstrator
Physics and Engineering Mathematics Dept., Faculty of Engineering, Zagazig University, Egypt — 2010-2014

EDUCATION

Ph.D., Mathematics and Physics, June 2019
- Faculty of Engineering, Zagazig University
- Thesis title: **"Nonlinear Analysis of Nano-structures"**
- Advisers: Prof. Dr. Salwa. A. Mohamed; Dr. Mohamed A. Attia; Dr. Norhan A. Mohamed

M.Sc., Mathematics and Physics, March 2014
- Faculty of Engineering, Zagazig University

- Thesis title: **"Multigrid Method and Compact Schemes on Nonuniform Mesh for The Solution of Partial Differential Equation in 2D and 3D"**
- Advisers: Prof. Dr. Salwa. A. Mohamed; Dr. Laila F. Seddek

B.Sc., Electronics and Communication Engineering, May 2010

- Electronics and Communication Engineering Dept., Faculty of Engineering, Zagazig University.
- Cumulative grade: 80.12%, Very Good with Honor

RESEARCH STATEMENT

I am working on the analytical and numerical solutions of linear and nonlinear partial differential equations describing the mechanical nanostructures; beams, plates, and shells. For solving these equations, I program my own original codes of the solutions using MATLAB and Maple programs.

In 2014, I got the master degree in mathematics. The master thesis title was "Multigrid Method and Compact Schemes on Nonuniform Mesh for The Solution of Partial Differential Equation in 2D and 3D". I developed a transformation free nonuniform high order compact scheme (HOCS) for solving the steady 3D convection-diffusion equation with variable coefficients. Effectiveness of this method is seen from the fact that it can handle the singularity perturbed problems by employing a flexible discretized grid that can be adapted to the singularity in domain. Part two of the thesis was an application of the HOCS. An efficient sixth-order finite difference discretization for the vibration analysis of a nonlocal Euler-Bernoulli beam embedded in an elastic medium was presented.

In 2019, I got the Ph.D. in mathematics. The thesis title is "Nonlinear Analysis of Nano-structures". A size-dependent nonlinear nonclassical functionally graded (FG) nanobeam model is developed including the simultaneous effects of microstructure local rotation and surface energy. The developed couple stress-surface energy model captures the scaling effect using the modified couple stress theory and the Gurtin-

Murdoch surface elasticity theory into the classical beam theory. Euler-Bernoulli and Timoshenko beam models including the von Kármán geometric nonlinearity are adopted. The size-dependent governing equations and corresponding nonclassical boundary conditions are exactly obtained through Hamilton's principle. The generalized differential quadrature method is employed to discretize the nonlinear nonclassical governing differential equations along with an exact implementation of the nonclassical boundary conditions for various end supports.

Future work and plans include continue working on the above research area and adapting other analytical and numerical methods for solving the governing equations describing the mechanical behavior of nanostructures; beams, CNT, plates, and shells. I am going to study the buckling and postbuckling responses of nanobeams using higher order beam theories and nanoplates.

INTERNATIONAL JOURNAL PUBLICATIONS

1. N. A. Mohamed, **R. A. Shanab**, M.A. Eltaher, A. A. Abdelrahman (2023). Vibration response of viscoelastic perforated higher-order nanobeams rested on an elastic substrate under moving load. Acta Mechanica, https://doi.org/10.1007/s00707-023-03776-z
1. H. M. Abo-bakr, R. M. Abo-bakr, **R. A. Shanab**, M. A. Eltaher (2023). Optimal material and geometry of 2D-FGM tapered microbeams under dynamic and static constraints, Mechanics Based Design of Structures and Machines, DOI: 10.1080/15397734.2023.2249984
2. M. A. Attia, **R. A. Shanab**. Dynamic analysis of 2DFGM porous nanobeams under moving load with surface stress and microstructure effects using Ritz method (2023). Acta Mechanica. https://doi.org/10.1007/s00707-023-03703-2.

3. N. A. Mohamed, **R. A. Shanab**, M.A. Eltaher, A. A. Abdelrahman (2023). Vibration Response of Viscoelastic Nanobeams including Cutouts under Moving Load. Results in Engineering. https://doi.org/10.1016/j.rineng.2023.101407
4. **R. A. Shanab**, N. A. Mohamed, M.A. Eltaher, A. A. Abdelrahman (2023). Dynamic Characteristics of Viscoelastic Nanobeams Including Cutouts. Advances in Nano Research, 14(1) 45-65. https://doi.org/10.12989/anr.2023.14.1.045
5. **R. A. Shanab**, Mohamed A. Attia (2023). On bending, buckling and free vibration analysis of 2D-FG tapered Timoshenko nanobeams based on modified couple stress and surface energy theories, Waves in Random and Complex Media, 33:3, 590-636, DOI: 10.1080/17455030.2021.1884770
6. O. A. Siam, **R. A. Shanab**, N. A. Mohamed, M.A. Eltaher (2023). Free vibration analysis of nonlocal viscoelastic nanobeam with holes and elastic foundations by Navier analytical method. Advances in Aircraft and Spacecraft Science, 10 (3) 257-279. https://doi.org/10.12989/aas.2023.10.3.257
7. A. Melaibari, S. A. Mohamed, A. Assie, **R. A. Shanab**, M. A. Eltaher (2023). Mathematical and Physical Analyses of Middle/Neutral Surfaces Formulations for Static Response of Bi-Directional FG Plates with Movable/Immovable Boundary Conditions.11, 2. https://doi.org/10.3390/math11010002
8. A. Melaibari, S. A. Mohamed, A. Assie, **R. A. Shanab,** M. A. Eltaher (2023). Free Vibration Characteristics of Bidirectional Graded Porous Plates with Elastic Foundations using 2D-DQM. 11, 46. https://doi.org/10.3390/math11010046
9. A. Assie, S. A. Mohamed, **R. A. Shanab**, Rasha M. Abo-bakr, M. A. Eltaher (2023). Static Buckling of 2D FG Porous Plates Resting on Elastic Foundation Based on Unified Shear Theories. The Journal of Applied and Computational Mechanics. 9(1) 239-258.DOI: 10.22055/jacm.2022.41265.3723

10. M.A. Eltaher, **R. A. Shanab**, N. A. Mohamed (2023). Analytical Solution of Free Vibration of Viscoelastic Perforated Nanobeam. Analytical solution of free vibration of viscoelastic perforated nanobeam. Arch Appl Mech. 93:221–243. https://doi.org/10.1007/s00419-022-02184-4
11. M. A. Attia, A. Melaibari, **R. A. Shanab,** M. A. Eltaher (2022). Dynamic analysis of sigmoid bidirectional FG microbeams under moving load and thermal Load: Analytical Laplace Solution. 10, 4797.https://doi.org/10.3390/math10244797
12. **R. A. Shanab**, S. A. Mohamed, M. Tharwan, A. Assie, M. A. Eltaher (2022). Buckling of 2D FG Porous unified shear plates resting on elastic foundation based on neutral axis (2022) Steel and Composite Structures, 45 (5) 729-747. https://doi.org/10.12989/scs.2022.45.5.729
13. A. A. Abdelrahman, **R. A. Shanab**, I. Esen, M. A. Eltaher (2022). Effect of moving load on dynamics of nanoscale Timoshenko CNTs embedded in elastic media based on doublet mechanics theory. Steel and Composite Structures, 44, (2) 241-256. https://doi.org/10.12989/scs.2022.44.2.241
14. **R. A. Shanab**, M. A. Attia (2022). Semi-analytical solutions for static and dynamic responses of bi-directional functionally graded nonuniform nanobeams with surface energy effect. Engineering with Computers, 38, 2269–2312. https://doi.org/10.1007/s00366-020-01205-6
15. M. A. Attia, **R. A. Shanab** (2022). On the dynamic response of bi-directional functionally graded nanobeams under moving harmonic load accounting for surface effect. Acta Mech 233, 3291–3317. https://doi.org/10.1007/s00707-022-03243-1
16. M. A. Attia, **R. A. Shanab** (2022). A comprehensive study of bending and stability responses of 2D-FG nanobeams using a microstructure-surface energy-based model under various boundary conditions. Journal of Nano Research, 73, 89–120. Trans Tech Publications, Ltd. https://doi.org/10.4028/p-8ur51p

17. S. A. Mohamed, L. Gamal, **R. A. Shanab**, A. E. Bakry (2022). A comparison of FEM and DIQM in investigating the nonlinear free vibration of axially functionally graded tapered microbeams with general boundary conditions. 282, 115027. https://doi.org/10.1016/j.compstruct.2021.115027
18. R. M. Abo-bakr, **R. A. Shanab**, M. A. Attia (2021)**,** Multi-objective optimization for lightweight design of bi-directional functionally graded beams for maximum frequency and buckling load. Composite Structures. 278, 114691, https://doi.org/10.1016/j.compstruct.2021.114691
19. M. A. Attia, **R. A. Shanab**, (2021). Vibration characteristics of two-dimensional FGM nanobeams with couple stress and surface energy under general boundary conditions. Aerospace Science and Technology. 111, 106552. https://doi.org/10.1016/j.ast.2021.106552
20. **R. A. Shanab**, S. A. Mohamed, N. A. Mohamed, M. A. Attia (2020). Comprehensive investigation of vibration of sigmoid and power law FG nanobeams based on surface elasticity and modified couple stress theories. Acta Mechanica, 1-34.
21. **R. A. Shanab**, M. A. Attia, S. A. Mohamed, N. A. Mohamed (2020). Effect of Microstructure and Surface Energy on the Static and Dynamic Characteristics of FG Timoshenko Nanobeam Embedded in an Elastic Medium, Journal of Nano Research. Trans Tech Publ, 97-117.
22. M. A. Attia, **R. A. Shanab**, S. A. Mohamed, N. A. Mohamed (2019). Surface energy effects on the nonlinear free vibration of functionally graded Timoshenko nanobeams based on modified couple stress theory. International Journal of Structural Stability and Dynamics. 19, 1950127. https://doi.org/10.1142/S021945541950127X
23. **R. A. Shanab**, M. A. Attia, S. A. Mohamed, N. A. Mohamed (2019). Analytical solution for bending of functionally graded Timoshenko nanobeams incorporating surface energy and microstructure effects. East African Scholars Journal of Engineering and Computer Sciences, 2(2):91-96.

24. **R. A. Shanab**, M. A. Attia, S. A. Mohamed (2017), Nonlinear analysis of functionally graded nanoscale beams incorporating the surface energy and microstructure effects, International Journal of Mechanical Sciences, 131–132 908–923.
25. S.A. Mohamed , **R. A. Shanab** , L.F. Seddek (2016), Vibration analysis of Euler Bernoulli nanobeams embedded in an elastic medium by a sixth-order compact finite difference method, Applied Mathematical Modelling, 40(3), 2396–2406.
26. **R. A. Shanab**, L. F. Seddek, S. A. Mohamed (2013), Non-uniform HOC scheme for the 3D convection–diffusion equation, Applied and Computational Mathematics, 2(3), 64-77.

FORTHCOMING PAPERS

1. A. A. Abdelrahman, **R A. Shanab**, I. Esen, M. A. Eltaher. Vibration of Functionally Graded CRNTRC Sandwich Nanobeams Embedded in Elastic Foundation under Moving Load.

TEACHING and EXPERIENCE

- Engineering mathematics (Level 0 students), including Calculus, Linear Algebra, Integration and analytic geometry with an experience of 8 years.
- Descriptive geometry (Level 0 students) with an experience of 3 years.
- Engineering mathematics (Level 1 students), including solution of partial and ordinary differential equations, special functions, Fourier series and Laplace transformation with an experience of 5 years.
- Post-graduate course, including numerical integration, solving nonlinear algebraic equation, and curve fitting and interpolation.
- Post-graduate course, including Finite difference, differential quadrature and shooting methods in solving partial differential equations and nonlinear systems.

- Post-graduate course, including solving linear partial differential equations using Navier and Ritz methods.

M. Sc. supervision

- **2021 to 2024**

Ola Abdellatif Omar Siam, Faculty of Engineering, Egyptian Russian University (*co-supervision* with Assoc. Prof. Dr. Norhan Alaa Eldin and Assoc. Prof. Dr. Mohamed Eltaher).

- **2020 to 2022**

Laila Gamal Hamed Abdelrahman, Faculty of Engineering, Zagazig University (*co-supervision* with Assoc. Prof. Dr. Salwa Amin Mohamed and Prof. Dr. Atef Eraky Bakry).

Ph. D. supervision

- **2024 to Present**

Laila Gamal Hamed Abdelrahman, Faculty of Engineering, Zagazig University (*co-supervision* with Assoc. Prof. Dr. Salwa Amin Mohamed and Prof. Dr. Mohamed Eltaher).