

EXECUTIVE SUMMARY

Mechanical and Structural Engineering leader and expert with over twenty five years of leading edge experience. Renowned expert and technical consultant in mechanical design, structural analysis, Finite Element Analysis (FEA), intellectual property analysis, patent infringement, perimeter security, transportation safety, materials testing and evaluation, nonlinear control systems. Strong forensic engineering expertise covering an extensive range of issues and assignments, including: accident reconstruction, accident causation, vehicle dynamics, biomechanics, safety analyses, seat belts, airbags, occupant protection systems, guardrails, crashworthiness, accident scene/roadway assessments, total station surveys of accident sites & vehicles, vehicle damage & crush analyses, computer simulations & animations, technical reports and expert testimony. Selected general areas of expertise:

- Mechanical Engineering
- Forensic Engineering / Accident Investigation
- Vehicle Crashworthiness and Transportation Safety
- Vehicle Dynamics and Vibration Analysis
- Structural Dynamics
- Nonlinear Finite Element Analysis (FEA)
- Physical Security Analysis
- Dynamics and Control of Nonlinear Systems

PROFESSIONAL EXPERIENCE

Advanced Research and Technology Corporation (ART) – McLean, VA

2002 – Present

Owner / President / Senior Consultant

ART is an engineering firm that performs analysis, design and peer review for all crash and impact-related problems. Experts at ART - all have Doctor of Science (D.Sc.) degree - have successfully conducted numerous transportation safety projects for several government agencies, private industries, attorneys, research institutions, and engineering firms.

Direct and conduct extensive design, analysis, and review for many projects in the areas of structural analysis, impact, crash, physical security and transportation safety. Some of the recently accomplished projects are:

- Analyzed numerous accident investigation/reconstruction cases, including: Crash scene and vehicle inspection, calculations and analysis, FEA/computer simulations, measurement and documentation, crash report writing, technical reports, and expert testimony.
- Conducted advanced and successful crash analyses of several highway accidents involving vehicle/guardrail impacts. Our crash analysis provided major compelling evidence and assisted in solving the case for the client.
- Analyzed and designed several highway steel, composite and concrete barriers (steel guardrails, concrete barriers, sign supports, posts, etc.) which resulted in better performance and less costly barriers.
- Analyzed and performed a test validation of automotive fuel tanks using advanced FEA techniques. The results provided a better understanding of and prediction regarding the fuel/structure interaction during the impact process. In addition, provided recommendations regarding how to mitigate the risk of a fuel tank explosion.
- Advanced analysis and improvement of several automotive airbag systems (frontal, head curtain and side airbags). The analysis improved the airbags' performance and enhanced their respective safety features.
- Conducted several research projects focused on various aspects of automotive and highway safety, and physical security barriers. Most of the research was carried out for the US Department of State, US Department of Energy, National Capital Planning Commission, and Ford Motor Company, among others.
- Reviewed and analyzed numerous structural security barriers (fixed and retractable bollards, security walls, gates, fences, wedge barriers, beams, cable barriers, etc.) for many renowned perimeter security providers.

George Washington University – Washington, D.C.

2002 – Present

Adjunct Professor

Taught several engineering courses: Vehicle dynamics, Finite Element crash simulation, Automotive safety standards, Crash investigation, Biomechanics, Stresses in Plates & Shells, Systems control and Intelligent Transportation Systems.

George Washington University – National Crash Analysis Center (NCAC), Ashburn, VA
Senior Research Scientist

1998 – 2002

NCAC is a renowned research center created in 1992 as a successful collaborative effort among the FHWA, the NHTSA and the GWU. The NCAC primarily supports the US-DOT strategic goal to reduce fatalities and injuries on the Nation's roadways and has successfully served to enhance safety worldwide.

Completed several research projects in intelligent transportation safety, vehicle crashworthiness, and highway safety. Most of the projects were done for government agencies (DOT, DOS, DOE, FHWA, and NHTSA) and private industry.

- Conducted advanced benefit analysis of the inflatable tubular structure (ITS) airbag - FEA and safety studies. The study results indicated a clear promising potential of using ITS airbags to protect drivers and passengers from side-impact fatalities/injuries.
- Performed many FE modeling and simulations for various vehicle structures and roadside hardware.
- Conducted Research topic is frontal vehicle stiffness in a car-to-car crash.
- Simulated vehicle to vehicle crashes using Finite Element Analysis software (LS-DYNA).
- Created and supervised a fixed-base vehicle simulator laboratory for intelligent transportation safety studies.
- Conducted advanced safety research for pre-crash driver assistance and collision avoidance for transportation safety and crash mitigation.
- Developed a special Artificial Neural Networks (ANN) for modeling any vehicle's crash in frontal and offset impacts. The developed ANN was successfully able to predict a vehicle's behavior during a collision.
- Conducted several advanced research focused on transportation safety, vehicle crashworthiness, and physical security protection. Research was carried out for the DOS, DOT, FAA, and private industry.

George Washington University – National Crash Analysis Center (NCAC), Ashburn, VA
Research Analyst

1994 – 1998

Participated in conducting several successful research projects for various government agencies and the American Automobile Manufacturers Association (AAMA). Some of the conducted projects are:

- An advanced FEA research of spot welded load carrying rails used in motor vehicles, comparing the crush behavior and energy absorbing capability of steel and aluminum rails. The results provided valuable recommendations for the auto industry to improve the crashworthiness of its vehicles.
- A comprehensive parametric study for the major simulation parameters of the non-linear FE code LS-DYNA. The study provided excellent information for researchers interested in using nonlinear FEA for analyzing and predicting vehicle crash/impact.
- Assisted in the design, analysis, manufacturing and control of The George Washington University solar car. The developed solar car gained worldwide attention and recognition after it came in ninth out of fifty-two entrants in the World Solar Challenge, 1,800-mile-long race across Australia.

EDUCATION

Doctorate of Science, Mechanical Engineering
George Washington University, Washington DC, 1999
Major: Solid Mechanics and Computer Aided Design
Minor: Control System and Robotics

Master of Science, Mechanical Engineering
Helwan University, Cairo, Egypt, 1992
Major: Structural Dynamics
Minor: Metal Cutting and Machine Tools

Bachelor of Science, Production and Design Engineering
Menoufia University, Egypt, 1984

PROFESSIONAL AFFILIATIONS AND AWARDS

TRB committee on Highway/Rail Grade Crossings (AHB60)
Committee Research Coordinator (CRC)

ASME Winter Annual Meeting, Transportation Safety Session
Member of the Organizing and Chairing Board since 2005

Member of **American Society of Mechanical Engineering (ASME)**

Member of **Society of Automotive Engineering (SAE)**

Advisory Board Member of **School of Drafting and Design (ITT)**

PUBLICATIONS

Published numerous technical papers and reports over the last 20 years; most of them are published in International journals and conferences. Selected publications are listed below. A complete list will be provided upon request.

1. Sadaat, S., Omar T., Olson E., and Ranganathan, P., "The Federal Railroad Administration's Automated Grade Crossing Survey System," Presented at the AREMA 2015 Annual Conference, Minneapolis, MN, October 4-7, 2015.
2. Omar T., and Bedewi, N., "New Shallow Foundation Security Barriers for Urban Applications – FEA and Certified Actual Crash Test," to be presented in the *ASME Winter Annual Meeting, Transportation Safety Session*, Orlando, FL, November 13-19, 2009.
3. Omar T., and Bedewi, N., "Structural Anti-Ram Barriers for Severe and Moderate Impacts - New Design, FEA and Test Validation," *Proceedings of the ASME Winter Annual Meeting, Transportation Safety Session*, Seattle, WA, November 11-15, 2007.
4. Omar, T., and Bedewi, N., "Modeling of Automotive Fuel Tanks Using Smoothed Particle Hydrodynamics," *Proceedings of the Society of Automotive Engineering (SAE) World Congress*, Detroit, MI, April 16-19, 2007.
5. Omar, T., and Bedewi, N., "Advanced Benefit Analysis of the ITS-Airbag in Vehicles' Side Impacts – FE Simulation and Severity Analysis," *Proceedings of the 10th International Conference on Aerospace Sciences & Aviation Technology*, ASAT-10, Cairo, Egypt, May 13-15, 2003.
6. Bedewi, N., and Omar, T., "Nonlinear FEA of Composite Materials for Crashworthiness Applications," 8th Annual International Conference on Composites Engineering, **ICCE/8**, Tenerife Island, Spain, August 5-11, 2001.
7. Omar, T., Eskandarian, A., and Bedewi, N., "Artificial Neural Networks for Modeling Dynamics of Impacting Bodies and Vehicles," *Journal of Multi-body Dynamics*, Vol. 214, Part K, pp. 133-142, 2000.
8. Omar, T., Bedewi, N., and Eskandarian, A., "Major Parameters Affecting Nonlinear Finite Element Simulations of Vehicle Crashes," *Proceedings of the ASME Winter Annual Meeting, Transportation Safety Session*, Nashville, TN, November 14-19, 1999.
9. Omar, T., Eskandarian, A., and Bedewi, N., "Vehicle Crash Modeling Using Recurrent Neural Networks," *Journal of Mathematical and Computer Modeling*, Vol. 28, No. 9, pp. 31-42, 1998.
10. Omar, T.A., Eskandarian, A., and Bedewi, N.E., "Crash Analysis of Two Vehicles in Frontal Impact Using Adaptive Artificial Neural Networks," *Proceedings of the ASME Winter Annual Meeting, Transportation Safety Session*, CA, November 15-20, 1998.
11. Omar T., Kan, C., and Bedewi, N., "Non-linear Finite Element Analysis of Box Beam Crush Buckling: Experimental Validation and Material Comparison," 29th International Symposium on Automotive Technology and Automation, Florence, Italy, June 1996.