

# Publications and Presentations

4/1/20224-9/30/2024

## *Publications*

1. Mirzaei, M., Radmehr, A., Holton, C., and Ahmadian, M., In-Motion, Non-Contact Detection of Ties and Ballasts on Railroad Tracks, *Applied Science*, September 2024, Vol. 14, Issue 19, pp. 8804 – 8823. <https://doi.org/10.3390/app14198804> (Virginia Tech)
2. Kasch, J. and Ahmadian, M., Design and Operational Assessment of a Railroad Track Robot for Railcar Undercarriage Condition Inspection, *Designs*, July 2024, Vol. 8, Issue 4, pp. 70 – 100. <https://doi.org/10.3390/designs8040070> (Virginia Tech)
3. Kumar, N., Radmehr, A., Ahmadian, M., Experimental Evaluation of Effect of Leaves on Railroad Tracks in Loss of Braking, *Machines*, April 2024, Vol. 12, pp. 301 – 318. <https://doi.org/10.3390/machines12050301> (Virginia Tech)
4. Chen, Y., Mirzaei, M., Holton, C., Ahmadian, M., Development of An Optical Sensing System for the Detection of Lubricity Conditions on the Rail Gage Face, *International Journal of Rail Transportation*, February 2024. (<https://doi.org/10.1080/23248378.2024.2309618>) (Virginia Tech)
5. Chen, Y., Chatterjee, R., Ahmadian, M., Electromagnetic Energy Harvester Tie: Design, Implementation, and Field Testing, the AREMA 2024 Annual Conference and Exposition, Louisville, KY, September 15 – 18, 2024. (Virginia Tech)
6. Kumar, N., Radmehr, A., Ahmadian, M., Assessment of contact patch on curving forces in two-point contact condition, the AREMA 2024 Annual Conference and Exposition, Louisville, KY, September 15 – 18, 2024. (Virginia Tech)
7. Ahmadian, M., Chen, Y., and Pan, Y., Laboratory and Field Evaluation of an Energy Harvesting Tie for Energy Generation on Railroad Tracks, *Railways 2024*, Prague, Czech Republic, September 1 – 5, 2024. (Virginia Tech)
8. Mohammed, O., Palese, J., Zaremski, A., Development of a 3D track quality index incorporating machine learning techniques and a multivariable normal distribution” to be submitted to a peer-reviewed professional journal, September 2024. (University of Delaware)
9. Ahmed, M., Palese, J., Zaremski, A., Predicting Track Geometry Using Machine-Learning Methods, to be submitted to a peer-reviewed professional journal, September 2024 (University of Delaware)
10. Palese, J., Zaremski, A., A Stochastic Approach to Rail Wear Rate Assessment and Forecasting Using Mixture Density Networks, to be submitted to a peer-reviewed professional journal, September 2024 (University of Delaware)
11. Mohammad, A.A., Wang, Z. Teng, H., Mechanical and Metallurgical Assessment of a Submerged Arc Welded Surfaced Rai, accepted by *International Journal of Transportation Science and Technology*, October 2024 (UNLV)
12. Mohammad, A.A., Wang, Z. Teng, H., Finite Element Modeling and Validation of Submerged Arc Welding for Repairing 136re Heavy Rails, Part F: *Journal of Rail and Rapid Transit*, January 2024. (UNLV)
13. Mohammad, A.A., Wang, Z., Teng, H., Finite Element Modeling and Validation of Submerged Arc Welding for Repairing 136re Heavy Rails, *Proceeding of International Conference on*

Transportation and Development 2024, June 13, 2024, Atlanta, George, United States. (UNLV)

14. Jia, L. Park, J.W., Zhu, M., Jiang, Y. Teng, H., Evaluation of On-Vehicle Acoustic Emission Detection for Rail Defects, submitted to the Journal of Transportation Technologies, September 2024 (UNLV)
15. Fan, J., Zhu, M., Jiang, Y., Teng, H., Development of a Platform to Enable Real Time, Non-disruptive Testing and Early Fault Detection of Critical High Voltage Transformers and Switchgears in High Speed-rail, submitted to International Journal of Transportation Science and Technology, September 2024 (UNLV)
16. Qiu, L., Zhu, M. Park, J.M., Jiang, Y., Teng, H., Non-Interrupting Rail Track Geometry Measurement System Using UAV and LiDA, submitted to International Journal of Transportation Science and Technology, September 2024 (UNLV)

*Books or other non-periodical, one-time publications*

Lei Jia, Non-Contact Acoustic Emission Approach for Rail Health Monitoring, Dissertation of Civil and Environmental Engineering, University of Nevada Las Vegas, Fall 2024 (UNLV)

*Other publications, conference papers and presentations*

1. Chen, Y., Chatterjee, R., Ahmadian, M., Electromagnetic Energy Harvester Tie: Design, Implementation, and Field Testing, the AREMA 2024 Annual Conference and Exposition, Louisville, KY, September 15 – 18, 2024. (Virginia Tech)
2. Kumar, N., Radmehr, A., Ahmadian, M., Assessment of contact patch on curving forces in two-point contact condition, the AREMA 2024 Annual Conference and Exposition, Louisville, KY, September 15 – 18, 2024. (Virginia Tech)
3. Ahmadian, M., Chen, Y., and Pan, Y., Laboratory and Field Evaluation of an Energy Harvesting Tie for Energy Generation on Railroad Tracks, Railways 2024, Prague, Czech Republic, September 1 – 5, 2024. (Virginia Tech)
4. Ahmadian, M., Southward, S., Mantovani, G., Shaju, A., In-motion Detection, Isolation, and Classification of Wheel Cracks using Air-coupled Ultrasonic Acoustic Emission (UAE) Methods, MxV Rail University Day, August 6 – 7, 2024. (Virginia Tech)
5. Mantovani, G., Kumar, N., Ahmadian, M., Virginia Tech-Federal Railroad Administration Roller Rig Measurement Capabilities and Efforts to Improve its Capabilities, 2024 Pacific Southwest Region 9 UTC Annual Congress, Las Vegas, NV, March 11 – 12, 2024. (Virginia Tech)
6. Kumar, N., Mantovani, G., Radmehr, A., Ahmadian, M., Experimental Evaluation of Loss of Braking due to Leaves on Railroad Tracks, 2024 Pacific Southwest Region 9 UTC Annual Congress, Las Vegas, NV, March 11 – 12, 2024. (Virginia Tech)
7. Chen, Y., Mirzaei, M., Holton, C., Ahmadian, M., Application of Laser-induced Fluorescence Technique for Measuring Lubricity Conditions on Rail Gage Face, 2024 Pacific Southwest Region 9 UTC Annual Congress, Las Vegas, NV, March 11 – 12, 2024. (Virginia Tech)
8. Mirzaei, M., Radmehr, A., Holton, C., Ahmadian, M., Leveraging Non-contact Doppler LiDAR Sensors and Unsupervised Algorithms for In-motion Assessment of Railroad Track Stability, 2024 Pacific Southwest Region 9 UTC Annual Congress, Las Vegas, NV, March 11 – 12, 2024. (Virginia Tech)

9. Ahmadian, M., Radmehr, A., Mirzaei, S. M. H., Condition Monitoring of Railroad Tracks in Revenue Service using Doppler Lidar Systems, the 8th International Conference on Condition Monitoring in Non-Stationary Operations (CMMNO 2024), Wenzhou, China, May 10 – 13, 2024. (Virginia Tech)
10. Palese, J. Mohammed, O., Ahmed, M., Using Long-Short-Term-Memory Networks and Mixture-Density Modeling to Predict and Classify Track Geometry at Cyber and Digital Information in Railway Engineering and Operations Workshop, University of Maryland, College Park, MD, March 2024 (University of Delaware)
11. Mohammadi, A.A. Wang, Z. Teng, H., Finite Element Analysis of Submerged Arc Welding Process for Surface Repair of Heavy Rails, Presentations at ASCE International Conference on Transportation and Development, Atlanta, June 17, 2024. (UNLV)

October 2023 – March 2024

### *Publications*

1. Shaju, A., Southward, S. C., and Ahmadian, M., Enhancing Autonomous Vehicle Navigation with a Clothoid-Based Lateral Controller, Applied Sciences, Volume 14, Issue 5, February 2024. (<https://doi.org/10.3390/app14051817>). (Virginia Tech)
2. Chen, Y., S. M. H. Mirzaei, Holton, C., Ahmadian, M., Development of An Optical Sensing System for the Detection of Lubricity Conditions on the Rail Gage Face, International Journal of Rail Transportation, February 2024. (<https://doi.org/10.1080/23248378.2024.2309618>). (Virginia Tech)
3. Chen, Y., Neighborgall, C., Zheng, X., and Ahmadian, M., Field Testing and Performance Evaluation of Roll Stability Control System of Double-trailer Trucks, Vehicle System Dynamics, accepted for publication, January 2024, pp. 1 – 20. (<https://doi.org/10.1080/00423114.2024.2304052>). (Virginia Tech)
4. Ahmadian, M., Chen, Y., Zhang, Z., Emergency collision avoidance maneuvers of multi-trailer articulated heavy vehicles, Vehicle System Dynamics, January 2024. (<https://doi.org/10.1080/00423114.2024.2305292>). (Virginia Tech)
5. Neighborgall, C., Chen, Y., and Ahmadian, M., Tyre lateral slip effect on off-tracking of a long combination vehicle, Vehicle System Dynamics, January 2024. (<https://doi.org/10.1080/00423114.2024.2304052>). (Virginia Tech)
6. Shaju, A., Southward, S. C., and Ahmadian, M., PID-Based Longitudinal Control of Platooning Trucks, Machines, Vol. 11, Issue 12, December 2023. (<https://doi.org/10.3390/machines11121069>). (Virginia Tech)
7. Zheng, X., Chen, Y., and Ahmadian, M., Interconnected Roll Stability Control System for Semitrucks with Double Trailers, SAE Technical Paper No. 2023-01-0906, 2023. (<https://doi.org/10.4271/2023-01-0906>). (Virginia Tech)
8. Soufiane, K, Zaremski, A. M. and Palese, J. W., Assessing the Impact of Deteriorating Adjacent Crossties on the Future Condition of a Central Crosstie: A Study Leveraging Unsupervised and Interpretable Machine Learning Techniques, submitted to Journal of Infrastructure Systems, November 2023. (University of Delaware)
9. Wang, Z., Zeng, Z., and Teng, H., Corrosion Test of the Steel Plate in a WJ-8 Fastener for High-Speed Rail, Journal of Transportation Technologies, Vol.14, Issue, 01, pp. 16-30, 2024. (UNLV)

10. Teng, H. and Kutela, B., Technical Feasibility Study of Passenger Rail Service along the West Route between Las Vegas and Los Angeles, *Journal of Transportation Technologies*, Vol. 13, Issue 4, pp. 746-755, 2023. (UNLV)
11. Mohammadi, A. Wang, Z., and Teng, H., Mechanical and Metallurgical Assessment of a Submerged Arc Surfaced Rail, submitted to the *Journal of Rail and Rapid Transit*, October 2023. (UNLV)
12. Mohammadi, A., Wang, Z., and Teng, H., Finite Element Analysis and Validation of Submerged Arc Welding for Repairing 136RE Heavy Rails, *International Journal of Transportation Science and Technology*, October 2023. (UNLV)

*Other publications, conference papers and presentations*

1. Chen, Y., Mirzaei, S. M. H., Holton, C., Ahmadian, M., Non-contact Detection and Evaluation of Rail Gage-face Lubricant using Optical Sensing Methods, the TTC Annual Conference, Pueblo, CO, November 7 – 8, 2023. (Virginia Tech)
2. Radmehr, A., Kumar, N., Ahmadian, M., Experimental Evaluation of Wheel/Rail Contact, Third Body Layer, and Surface Finish on Risk of Derailment,” the TTC Annual Conference, Pueblo, CO, November 7 – 8, 2023. (Virginia Tech)
3. Ahmadian, M., Safety Evaluation of Interconnected Roll Stability Control Systems for Articulated Commercial Vehicles, The 16th IFToMM World Congress, Tokyo, Japan, November 5 – 11, 2023. (Virginia Tech)
4. Kumar, N., Ahmad Radmehr, A. Ahmadian, M., Experimental Evaluation of Effect of Leaves on Railroad Tracks in Loss of Braking, The University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 12, 2024. (Virginia Tech)
5. Chen, Y., Morteza S. Mirzaei, H., Holton, C., and Ahmadian, M., Application of Laser-induced Fluorescence Technique for Measuring Lubricity Conditions on Rail Gage Face, Presentation at the University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 12, 2024. (Virginia Tech)
6. Kumar, N. Mantovani, G., and Ahmadian, M., Virginia Tech-Federal Railroad Administration Roller Rig Measurement Capabilities and Efforts to Improve its Capabilities, Presentation at the University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 12, 2024. Virginia Tech)
7. Morteza, S., Mirzaei, H., Radmehr, A. Holton, C., and Ahmadian, M., Leveraging Non-contact Doppler LiDAR Sensors and Unsupervised Algorithms for In-motion Assessment of Railroad Track Stability, Presentation at the University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 12, 2024. (Virginia Tech)
8. Ahmed, M. and Palese, J., Predicting Track Geometry Using Machine-Learning Methods, Presentations at Big Data in Railroad Maintenance Planning 2023, December 13-14, 2023, Newark Delaware. (University of Delaware)
9. Mohammed, O. and Palese, J., Development of a 3D Track Quality Index Incorporating Machine Learning Techniques and a Multivariable Normal Distribution. Presentations at Big Data in Railroad Maintenance Planning 2023, December 13-14, 2023, Newark Delaware. (University of Delaware)

10. Soufiane, K., The Effect of Adjacent Tie Condition on Wood Cross-tie Life, Presentations at Big Data in Railroad Maintenance Planning 2023, December 13-14, 2023, Newark Delaware. (University of Delaware)
11. Palese, J., Using Long Short-Term-Memory Networks and Mixture Density Modeling to Predict and Classify Track Geometry. Presentation at Cyber and Digital Information in Railway Engineering and Operations, University of Maryland, College Park, MD, March 7-8, 2024. (University of Delaware)
12. Soufiane, K., Zarembski, A.M., and Palese, J.W., Effect of Adjacent Poor Ties on the Life of Wood Crossties, The University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 12, 2024. (University of Delaware)
13. Jia, J., Park, J.W., Zhu, M., Jiang, Y. and Teng, H., Acoustic Emission Technology Based Method Proposed for Real-time Rail Monitoring, The University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 12, 2024. (UNLV)
14. Qiu, L., Zhu, M., Jiang, Y., and Teng, H., Development of Multi-Rotor-UAV-based Rail Track Irregularity Monitoring and Measuring Platform with Image and LIDAR Sensors, The University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 12, 2024. (UNLV)
15. Zhu, M. and Jiang, Y., Development of a Platform to Enable Real time, Non-Disruptive Testing and Early Fault Detection of Critical High Voltage Transformers and Switchgears in High Speed Rail, The University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 11-12, 2024. (UNLV)
16. Mohammadia, A., Wang, Z., and Teng, H., 3D Printing to Repair Worn Rail, The University Transportation Center's 2024 PSR Annual Congress, Moving Forward: Improving Transportation in Region 9, Las Vegas, Nevada, March 12, 2024. (UNLV)
17. Mohammadia, A., Wang, Z., and Teng, H., Finite Element Analysis of Submerged Arc Welding Process for Surface Repair of Heavy Rails, accepted for presentation and publication by the 19th International Conference on Automated People Movers and Automated Transit Systems, Atlanta, June 2024. (UNLV)

### Semi-Annual Report (4/1/23 to 9/30/23)

#### *Publications*

1. Huang, M., Ahmadian, M., Rahimi, A., and Steinginga, L., Dynamics Performance of Long Combination Vehicles with Active Control Systems, *Vehicle System Dynamics*, Vol. 61, No. 7, May 2023, pp. 1829 - 1878. (<https://doi.org/10.1080/00423114.2023.2194545>). (Virginia Tech)
2. Ali, G., McLaughlin, S., and Ahmadian, M., The Surface Accelerations Reference — A Large-Scale, Interactive Catalog of Passenger Vehicle Accelerations, *IEEE Transactions on Intelligent Transportation Systems*, April 2023 (online). (<https://doi.org/10.1109/TITS.2023.3267844>). (Virginia Tech)

3. Radmehr, A., Mirzaei, M., Larson, I., Holton, C., and Ahmadian, M., Railroad Track Gage Widening Assessment Using On-board Doppler LiDAR Velocity Measurements and Unsupervised Machine Learning Technique, The 2023 International Association of Vehicle System Dynamics (IAVSD) Bi-Annual Conference, Ottawa, Canada, August 21 – 25, 2023. (Virginia Tech)
4. Chen, Y., Neighborgall, C., Zheng, X., and Ahmadian, M., Field Testing and Performance Evaluation of Roll Stability Control System of Double-trailer Trucks, The 2023 International Association of Vehicle System Dynamics (IAVSD) Bi-Annual Conference, Ottawa, Canada, August 21 – 25, 2023. (Virginia Tech)
5. Zhang, Z., Chen, Y., and Ahmadian, M., Interconnected Roll Stability Control System for Semitrucks with Double Trailers, 2023-01-0906, ISSN: 0148-7191, e-ISSN: 2688-3627, WCX SAE International World Congress Experience, Detroit, MI, April 18 – 20, 2023. (Virginia Tech)
6. Soufiane, K, Zarembski, A. M. and Palese, J. W., Forecasting Crosstie Condition Based on the Dynamic Adjacent Support Using a Theory-Guided Neural Network Model” Proceedings of the Institution of Mechanical Engineers, Journal of Rail and Rapid Transit, September 2023 <https://doi.org/10.1177/09544097231203275>. (University of Delaware)
7. Olubode, O., Pantograph Carbon Strip Degradation Monitoring – Pulsed Power Application Using Electromagnetic Dot, Dissertation, Department of Electrical and Computer Engineering, University of Nevada, Las Vegas. August 2023. (University of Nevada Las Vegas)
8. Hasnat,A., Development of Non-Proprietary Ultra-High-Performance Concrete and Railway Tie Application Ph.D. Dissertation, Department of Civil and Environment Engineering and Construction, University of Nevada, Las Vegas, June 2023. (University of Nevada Las Vegas)
9. Hasnat, A. and Ghafoori, N., Transport Properties and De-icing Salt Resistance of Blended Ultra High-Performance Concrete. ASCE Journal of Cold Regions Engineering, 2023, DOI: 10.1061/JCRGEI/CRENG-724. (University of Nevada Las Vegas)

*Other publications, conference papers and presentations*

1. Ahmadian, M., Dynamics Performance of Long Combination Vehicles with Active Control Systems, Keynote Presentation at the 2023 International Association of Vehicle System Dynamics (IAVSD) Bi-Annual Conference, Ottawa, Canada, August 21 – 25, 2023. (Virginia Tech)
2. Ahmadian, M., Railroad Track Gage Widening Assessment Using On-board Doppler LiDAR Velocity Measurements and Unsupervised Machine Learning Technique, Presentation at the 2023 International Association of Vehicle System Dynamics (IAVSD) Bi-Annual Conference, Ottawa, Canada, August 21 – 25, 2023. (Virginia Tech)
3. Ahmadian, M., Field Testing and Performance Evaluation of Roll Stability Control System of Double-trailer Trucks, Presentation at the 2023 International Association of Vehicle System Dynamics (IAVSD) Bi-Annual Conference, Ottawa, Canada, August 21 – 25, 2023. (Virginia Tech)
4. Soufiane, K, Zarembski, A. M. and Palese, J. W., Effect of Failing Adjacent Crossties on Tie-Life: A Machine Learning Model, International Heavy Haul Railways Conference, Rio de Janeiro, Brazil, August 2023 (University of Delaware)

## Semi-Annual Report (10/1/22 - 3/31/23)

### *Publications*

1. Pan, Y., Zuo, L., and Ahmadian, M., A Half-wave Electromagnetic Energy-Harvesting Tie towards Safe and Intelligent Rail Transportation, *Applied Energy*, 313(4):118844, May 2022. (<https://doi.org/10.1016/j.apenergy.2022.118844>). (Virginia Tech)
2. Soufiane, K., Zarembski, A. M., and Palese J. W., The Contribution of Crosstie Condition as Represented by Local Track Stiffness to the Wheel Load Distribution”, *Journal of Transportation Infrastructure Geotechnology*, November 2022. <https://doi.org/10.1007/s40515-022-00263-1>. (University of Delaware)
3. Soufiane, K, Zarembski, A. M. and Palese, J. W., Forecasting Crosstie Condition Based on the Dynamic Adjacent Support Using a Theory-Guided Neural Network Model, submitted to *Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit*, March 2023. (University of Delaware)
4. Stanik, P. III, Real-Time Semantic Segmentation for Railway Anomalies Analysis, MS Thesis, Department of Electrical and Computer Engineering, University of Nevada, Las Vegas, May 2023. (University of Nevada Las Vegas)

### *Other publications, conference papers and presentations*

1. Radmehr, A. and Ahmadian, M., Can Machine Learning Methods Improve the Identification of Unstable Tracks?” *Big Data in Railroad Maintenance Planning 2022*, Newark, DE, December 14 – 15, 2022. (Virginia Tech)
2. Soufiane, K., Zarembski, A. M. and Palese, J. W., Effect of Failing Adjacent Crossties on Tie-Life: A Machine Learning Model, *International Heavy Haul Railways Conference*, Rio de Janeiro Brazil, August 2023. (University of Delaware)
3. Palese, J. and Mohamed, O., University of Delaware, “Development of a Multi-Dimensional Time-Based Track Safety and Quality Index” Presentation at *Big Data in Railroad Maintenance Planning Conference*, December 2022, Newark, DE. (University of Delaware)
4. Zarembski, A. M. and Soufiane, K., The Effect of Adjacent Tie Condition on Wood Cross-tie Life, Presentation at *Big Data in Railroad Maintenance Planning Conference*, December 2022, Newark, DE. (University of Delaware)

## Semi-Annual Report (4/01/22 - 9/30/22)

### *Publications*

1. Pan, Y., Zuo, L., and Ahmadian, M., A Half-wave Electromagnetic Energy-Harvesting Tie towards Safe and Intelligent Rail Transportation, *Applied Energy*, 313(4):118844, May 2022. (<https://doi.org/10.1016/j.apenergy.2022.118844>). (Virginia Tech)
2. Soufiane, K., Zarembski, A. M., and J. W. Palese, The Contribution of Crosstie Condition as Represented by Local Track Stiffness to the Wheel Load Distribution, submitted to *Journal of Transportation Infrastructure Geotechnology*, August 2022. (University of Delaware)



3. Mortazavian, E., Mobile 3D Printing of Rail Track Surface for Rapid Repair, Ph.D. Dissertation, Department of Mechanical Engineering, University of Nevada Las Vegas, August 2022. (University of Nevada Las Vegas)
4. Qiu, L., Development of UAV-Based Rail Track Geometry Irregularity Monitoring and Measuring Platform Empowered by Artificial Intelligence, Department of Electrical and Computer Engineering, University of Nevada, Las Vegas, May 2022. (University of Nevada Las Vegas)

*Other publications, conference papers and presentations*

5. Michael, M. and Ahmadian, M., Improving Trackside Inspection of Rolling Stock Using a Track Crawler Robot: A Step Toward Better Diagnosis and Prognosis of Railcars, Railroad Infrastructure Diagnosis and Prognosis Symposium – RailTEAM UTC, Roanoke, VA, May 2022. (Virginia Tech)
6. Radmehr, A. and Ahmadian, M., Early Diagnosis of Track Stability through Non-contact LiDAR Measurements and Unsupervised Machine Learning Algorithms, Railroad Infrastructure Diagnosis and Prognosis Symposium – RailTEAM UTC, Roanoke, VA, May 2022. (Virginia Tech)
7. Zaremski, A. M., Palese, J. W., and Nguyen, M., Forecasting Track Geometry Degradation Using GPR Based Ballast Condition, American Society of Mechanical Engineers Joint Rail Conference 2022, April 2022, Baltimore, MD. (University of Delaware)
8. Palese, J. W. and Zaremski, A. M., Predicting Rail Transverse Profile Shape Using 2D ARIMA Modeling, American Railway Engineering and Maintenance of Way Association Annual Conference, Denver, CO, August 2022. (University of Delaware)
9. Attoh-Okine, N., Theory Guided Data Science and Railway Informatics, Railroad Infrastructure Diagnosis and Prognosis Symposium – RailTEAM UTC, Roanoke, VA, May 2022. (University of Delaware)
10. Palese, J. W., A Data Driven Approach to Predicting Rail Transverse Profile Shape, Railroad Infrastructure Diagnosis and Prognosis Symposium – RailTEAM UTC, Roanoke, VA, May 2022. UTC support acknowledged (University of Delaware)
11. Zhiyong “John” Wang, 3D Printing Rail Surface for On-Site Repair, University of Nevada Las Vegas (UNLV), Railroad Infrastructure Diagnosis and Prognosis Symposium – RailTEAM UTC, Roanoke, VA, May 2022. (University of Nevada Las Vegas)
12. Kaseko, M. and Boyapati, K., Development of a Framework for Determination of Access Charges on a Shared High-Speed Rail (HSR) Corridor Using VISSIM Simulation, (University of Nevada Las Vegas)

**Semi-Annual Report (10/1/21 to 3/31/22)**

*Publications*

1. Pan, Y., Zuo, L., and Ahmadian, M., A Half-wave Electromagnetic Energy-Harvesting Tie towards Safe and Intelligent Rail Transportation, Applied Energy, 313(4):118844, May 2022. (<https://doi.org/10.1016/j.apenergy.2022.118844>). (Virginia Tech)
2. Soufiane, K., Zaremski, A. M., and Palese J. W., The Contribution of Crosstie Condition as Represented by Local Track Stiffness to the Wheel Load Distribution”, Journal of



Transportation Infrastructure Geotechnology, November 2022.  
<https://doi.org/10.1007/s40515-022-00263-1>. (University of Delaware)

3. Soufiane, K, Zarembski, A. M. and Palese, J. W., Forecasting Crosstie Condition Based on the Dynamic Adjacent Support Using a Theory-Guided Neural Network Model, submitted to Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, March 2023. (University of Delaware)
4. Stanik, P. III, Real-Time Semantic Segmentation for Railway Anomalies Analysis, MS Thesis, Department of Electrical and Computer Engineering, University of Nevada, Las Vegas, May 2023. (University of Nevada Las Vegas)

*Other publications, conference papers and presentations*

1. Radmehr, A. and Ahmadian, M., Can Machine Learning Methods Improve the Identification of Unstable Tracks? Big Data in Railroad Maintenance Planning 2022, Newark, DE, December 14 – 15, 2022. (Virginia Tech)
2. Soufiane, K., Zarembski, A. M. and Palese, J. W., Effect of Failing Adjacent Crossties on Tie-Life: A Machine Learning Model, International Heavy Haul Railways Conference, Rio de Janeiro Brazil, August 2023. (University of Delaware)
3. Palese, J. and Mohamed, O., University of Delaware, “Development of a Multi-Dimensional Time-Based Track Safety and Quality Index” Presentation at Big Data in Railroad Maintenance Planning Conference, December 2022, Newark, DE. (University of Delaware)
4. Zarembski, A. M. and Soufiane, K., The Effect of Adjacent Tie Condition on Wood Cross-tie Life, Presentation at Big Data in Railroad Maintenance Planning Conference, December 2022, Newark, DE. (University of Delaware)

**Semi-Annual Report (4/01/21 - 9/30/21)**

*Publications*

1. Pan, Y., Zuo, L., and Ahmadian, M., A Half-wave Electromagnetic Energy-Harvesting Tie towards Safe and Intelligent Rail Transportation, Applied Energy, in review. (Virginia Tech)
2. Hosseini, S-M, Ahangarnejad, A. H., Radmehr, A., and Ahmadian, M., A Statistical Evaluation of Multiple Regression Models for Contact Dynamics in Rail Vehicles Using Roller Rig Data, International Journal of Rail Transportation, in review. (Virginia Tech)
3. Pan, Y, Radmehr, A., Tajaddini, A., and Ahmadian, M., An Experimental Study of the Influence of the Amount of Top-of-Rail Friction Modifiers on Traction, Proceedings of the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
4. Pan, Y., Mast, T., Holton, C., and Ahmadian, M., Performance Evaluation of a Novel Optical Sensing System for Detecting Rail Lubricity Conditions, Proceedings of the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
5. Pan, Y., Mast, T., Holton, C., and Ahmadian, M., Intermediate Distance Testing of Optical ToR Lubricity Sensors on a Remote-controlled Rail Cart, Proceedings of the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
6. Hosseini, S-M, Ahangarnejad, A.H., Radmehr, A., Tajaddini, A., and Ahmadian, M., A Statistical Approach to Evaluating Wheel-Rail Contact Dynamics, Proceedings of the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)

7. Cronin, J. J., Zarembski A. M., and Palese J. W., Prediction of Rail Defect Development using Parametric Bootstrapping Modified Weibull Equations, Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, May 2021. doi.org/10.1177/09544097211020583, (University of Delaware)
8. Musazay, J., Zarembski, A. M. and Palese, J. W., Determining Track-Induced Lateral Thermal Expansion Forces on A Curved Railway Track, Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, February 2021. DOI 10.1177/09544097211995318, (University of Delaware)
9. Balogun, I. and Attoh-Okine, N., Random Forest–Based Covariate Shift in Addressing Nonstationarity of Railway Track Data, ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering, 2021, 7(3): 04021028, 2021, (University of Delaware)
10. Soufiane, K., Zarembski, A. M., and Palese, J. W., Effect of Adjacent Support Condition on Premature Wood Crosstie Failure, Journal of Transportation Infrastructure Geotechnology, May 2021. DOI doi.org/10.1007/s40515-021-00168-5, (University of Delaware)
11. Mortazavian, E., Wang, Z., and Teng, H., Finite Element Investigation of Residual Stresses during Laser Powder Deposition Process as an Innovative Technique to Repair Worn Rails, submitted to proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit. (Resubmitted date: July 1, 2021). (University of Nevada Las Vegas)
12. Mortazavian, E., Wang, Z., and Teng, H., X-Ray Diffraction Measurement of Residual Stress in Laser Powder Deposition Process as a Potential Rail Repair Technique, Proceedings of the ASME 2021 International Mechanical Engineering Congress and Exposition, IMECE2021, November 1-5, 2021, Virtual, Online. (University of Nevada Las Vegas)

*Books or other non-periodical, one-time publications*

1. Pan, Y. and Ahmadian, M. An Energy-Harvesting Railroad Tie for Improving Track Condition Monitoring and Safety, Quarterly Issue 4, U.S. Department of Transportation, Office of the Assistant Secretary for Research and Technology, October 2021. (Virginia Tech)
2. Radmehr, A., Pan, Y., Tajaddini, A., and Ahmadian, M., Wheel-Rail Contact Force and Wear Analysis Under Wet Surface Condition, the 2021 Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022. Abstract accepted, paper in preparation. (Virginia Tech)
3. Molzon, M. and Ahmadian, M., Development of a Mobile Robot System for the Visual Inspection of Railcar Undercarriage Equipment, the 2021 Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022. Abstract accepted, paper in preparation. (Virginia Tech)
4. Hosseini, S-M, Radmehr, A., and Ahmadian, M., Data Visualization using Google Earth Engine Coupled with Unsupervised Learning, A Practical Approach to Detecting Track Instability, the 2021 Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022. Abstract accepted, paper in preparation. (Virginia Tech)
5. Radmehr, A., Pan, Y., Tajaddini, A., and Ahmadian, M., Experimental Evaluation of the Effect of Rail Cant Angle on the Wheel-Rail Contact Forces, Traction Coefficients, and Contact Patch Shapes, 2021 Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022. Abstract accepted, paper in preparation. (Virginia Tech)
6. Mast, T., Radmehr, A., Hosseini, S-M, Hosseinian, A., Holton, C., and Ahmadian, M., Onboard Installation of LiDAR Doppler Systems for Track Instability Measurements, 2021

- Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022. Abstract accepted, presentation will be made at the conference. (Virginia Tech)
7. Pan, Y. and Ahmadian, M., Design and Field Testing of an Energy Harvester Tie: Enabling Rail Safety and Connectivity, 2021 Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022. Abstract accepted, presentation will be made at the conference. (Virginia Tech)
  8. Hosseini, S-M., Hosseinian, A., and Ahmadian, M., Unleashing the Power of Statistical Data-driven Models for Analyzing Complex Engineering Data, the 2021 Joint Rail Conference, Baltimore, MD, April 20 – 21, 2022. Abstract accepted, presentation will be made at the conference. (Virginia Tech)
  9. Olubode, O. and Schill R., Static Degradation Monitoring of Carbon Strip in Pantograph-Catenary System using Electromagnetic Dots, 2021 Fall Transportation Conference, Las Vegas, Nevada, November 4-5, 2021. Abstract accepted, presentation will be made at the conference. (University of Nevada Las Vegas)

*Other publications, conference papers and Presentations*

1. Ahmadian, M. Keynote Lecture: LiDAR System Applications for Improving Condition Monitoring and Asset Management of Railways, The Seventeenth International Conference on Condition Monitoring and Asset Management, Plenary Lecture, London, England, September 6 – 10, 2021. (Virtual). (Virginia Tech)
2. Ahmadian, M. Keynote Lecture: Achieving Improved Understanding of Wheel-Rail Interface Dynamics Through Roller Rig Testing, International Conference on Rail Transportation (ICRT2021), Chengdu, China, July 5 – 6, 2021. (Virtual). (Virginia Tech)
3. Zarembski, A. M., Palese, J. W., Soufiane, K. and Grissom, G., How Do Failed Adjacent Ties Effect the Life of Wood Crossties, Railway Track & Structures, April 202, (University of Delaware)
4. Ashley, G., Balogun, I., Prosper, A., and Attoh-Okine, N, Prediction of Track Geometry Defect Severity Using Machine Learning Techniques, accepted for presentation at 2022 Transportation Research Board, (University of Delaware)
5. Soufiane, K, Zarembski, A. M., and Palese, J, Impact of Adjacent Support Condition on Premature Crosstie Failure, Railway Tie Association Annual Symposium and Technical Conference, November, 2021, (University of Delaware)

**Semi-Annual Report (10/01/2020 - 3/31/2021)**

*Publications*

1. Yu, P., Radmehr, A., Tajaddini, A., and Ahmadian, M., An Experimental Study of the Influence of the Amount of Top-of-Rail Friction Modifiers on Traction, Proceedings of the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
2. Yu, P., Mast, T., Holton, C., and Ahmadian, M., Performance Evaluation of a Novel Optical Sensing System for Detecting Rail Lubricity Conditions,” Proceedings of the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
3. Yu, P., Mast, T., Holton, C., and Ahmadian, M., Intermediate Distance Testing of Optical Tor Lubricity Sensors on a Remote-controlled Rail Cart, Proceedings of the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)

4. Hosseini, S-M, Hosseinian Ahangarnejad, A., Radmehr, A., Tajaddini, A., and Ahmadian, M., A Statistical Approach to Evaluating Wheel-Rail Contact Dynamics, Proceedings of the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
5. Alsahli, A., Zarembski, A.M., and Attoh-Okine, N., Predicting Track Geometry Defect Probability Based on Tie Conditions Using Pattern Recognition Techniques, Proceedings of the ASME International Mechanical Engineering Congress and Exposition (IMECE2020), Portland, OR, November 2020. (University of Delaware)
6. Musazay, J., Zarembski, A. M. and Palese, J. W., Determining Track-Induced Lateral Thermal Expansion Forces on a Curved Railway Track, Proceedings of IMechE Part F: Journal of Rail and Rapid Transit, February 2021. DOI 10.1177/0954409721995318. (University of Delaware).
7. Ashley, G., and Attoh-Okine, N., Approximate Bayesian computation for railway track geometry parameter estimation, Journal of Rail and Rapid Transit, November 2020. DOI 10.1177/09544097209777726. (University of Delaware).
8. Hasnat, A. & Ghafoori, N. (2021). Abrasion Resistance of Ultra-High Performance Concrete for Railway Sleepers. Journal of Urban Rail Transit. Springer, DOI: 10.1007/s40864-021-00145-8. (University of Nevada Las Vegas)
9. Hasnat, A. & Ghafoori, N. (2021). Freeze-Thaw Resistance of Non-Proprietary Ultra-High Performance Concrete. Journal of Cold Regions Engineering. ASCE, DOI: 10.1061/(ASCE)CR.1943-5495.0000255. (University of Nevada Las Vegas)
10. Hasnat, A. & Ghafoori, N. (2021). Properties of Ultra-High Performance Concrete using Traditional Aggregates. Construction and Building Materials, Elsevier (under Revision) (University of Nevada Las Vegas)
11. Mortazavian, E., Wang, Z., Teng, H., Finite Element Investigation of Thermal-kinetic-mechanical Evolutions during Laser Powder Deposition as an Innovative Technique for Rail Repair", under review in Journal of Manufacturing Processes, Manuscript no. SMEJMP-D-20-02177. (Initial submission date: Oct 21, 2020) (University of Nevada Las Vegas)
12. Mortazavian, E., Wang, Z., Teng, H., Effect of Heat Treatment on Microstructure and Hardness of a Worn Rail Repaired using Laser Powder Deposition, revised version under review in International Journal of Transportation Science and Technology, Manuscript no. IJTST-D-20-00223R1. (revised submission date: Apr 03, 2021) (University of Nevada Las Vegas)
13. Mortazavian, E., Wang, Z., Teng, H., Finite Element Investigation of Residual Stresses during Laser Powder Deposition Process as an Innovative Technique to Repair Worn Rails, submitted to International Journal of Transportation Science and Technology. (Initial submission date: Apr 18, 2021) (University of Nevada Las Vegas)
14. Mortazavian, E., Wang, Z., Teng, H., Measurement of Residual Stresses in Laser 3D Printed Train Rail using X-Ray Diffraction Technique, to be submitted to Proceedings of the ASME 2021 International Mechanical Engineering Congress & Exposition, Manuscript no. IMECE2021-69822. (Abstract accepted on Mar 17, 2021) (University of Nevada Las Vegas)

*Other publications, conference papers and Presentations*

1. Yu, P., Radmehr, A., Tajaddini, A., and Ahmadian, M., An Experimental Study of the Influence of the Amount of Top-of-Rail Friction Modifiers on Traction, 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
2. Yu, P., Mast, T., Holton, C., and Ahmadian, M., Performance Evaluation of a Novel Optical Sensing System for Detecting Rail Lubricity Conditions, the 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
3. Yu, P., Mast, T., Holton, C., and Ahmadian, M., Intermediate Distance Testing of Optical Tor Lubricity Sensors on a Remote-controlled Rail Cart, 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
4. Hosseini, S-M, Hosseinian Ahangarnejad, A., Radmehr, A., Tajaddini, A., and Ahmadian, M., A Statistical Approach to Evaluating Wheel-Rail Contact Dynamics, 2021 Joint Rail Conference, St. Louis, Mo, April 20 – 21, 2021. (Virginia Tech)
5. Attoh-Okine, N., Shortcomings of Current Machine Learning Techniques in Railway Track Engineering, Big Data in Railroad Maintenance, virtual conference, December 2020. (University of Delaware)
6. Zarembski, A. M., Palese, J., Soufiane, K., and Grissom, G., How Do Failed Adjacent Ties Effect the Life of Wood Cross-ties, Railway Track and Structures, April 2021. (University of Delaware)
7. Zarembski, A. M., Using Data Science to Better Understand and Maintain Rolling Stock Performance, Railway Age, February 2021. (University of Delaware)
8. Zarembski, A. M., Using Data Science to Better Understand and Maintain Right of Way Performance, Railway Age, March 2021. (University of Delaware)

### **Semi-Annual Report (4/01/20 - 9/30/2020)**

#### *Publications*

1. Mast, T., Neighborgall, C., Peterson, A., Holton, C., and Ahmadian, M., Sensor Selection Consideration for Top-of-Rail (TOR) Lubrication Detection, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. (Virginia Tech)
2. Radmehr, A., Ahangarnejad, A.H., Tajaddini, A., and Ahmadian, M., Surface Profile and Third-body Layer Accumulation Measurement Using a 3D Laser profiler, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. (Virginia Tech)
3. Afzalan, M., Jazizadeh, F.K., and Ahmadian, M., Towards Railway Automated Defect Detection from Onboard Data using Deep Learning, Proceedings of the 2020 Joint Rail Conference, St. Louis, Mo, April 20-21, 2020. (Virginia Tech)
4. Radmehr, A., Ahangarnejad, A.H., Tajaddini, A., and Ahmadian, M., Influence of Angle of Attack on Wheel-rail Interface (WRI) Dynamics Under Various Friction Conditions, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. (Virginia Tech)
5. Tan, Y., Hosseini, S-M, Chen, Y., and Ahmadian, M., Simulation Evaluation of Fouled Ballast Thermal Characteristics, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. (Virginia Tech)
6. Dama, N. and Ahmadian, M., Discrete Element Modeling of Railway Ballast for Studying Railroad Tamping Operation, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. (Virginia Tech)

7. Hosseini, S-M, Tan, Y., and Ahmadian, M., Forward-Looking Infrared Radiometry (FLIR) Application for Detecting Ballast Fouling, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. (Virginia Tech)
8. Radmehr, A., Ahangarnejad, A.H., Pan, Y., Tajaddini, A., and Ahmadian, M., Wheel-Rail Contact Patch Geometry Measurement and Shape Analysis Under Various Loading Conditions, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. (Virginia Tech)
9. Alsahli, A, Zarembski, A.M., and Attoh-Okine, N., Predicting Track Geometry Defect Probability Based on Tie Conditions Using Pattern Recognition Techniques, Proceedings of the ASME International Mechanical Engineering Congress and Exposition (IMECE2020), Portland, OR, November 2020. (University of Delaware)
10. Cronin, J.J., Zarembski A.M., and Palese J.W., Prediction of Rail Defect Development Using Parametric Bootstrapping Modified Weibull Equations, submitted to The Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, September 2020. (University of Delaware)
11. Ashley, G., and Attoh-Okine, N., Approximate Bayesian Computation for Railway Track Geometry Parameter Estimation”, accepted by The Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, September 2020. (University of Delaware)
12. Hasnat, A., and Ghafoori, N., Freeze-Thaw Resistance of Non-Proprietary Ultra High Performance Concrete, submitted to the ASCE Journal of Cold Regions Engineering, June 2020. (UNLV)
13. Mortazavian, E., Wang, Z. and Teng, H., Finite Element Analysis of Thermal Kinetic-Mechanical Evolutions during Laser Metal 3D Printing Process as a Potential Technique for Rail Repair, submitted to the Journal of Manufacturing Science and Engineering, April 2020. (UNLV)
14. Mortazavian, E., Wang, Z. and Teng, H., A Finite Element Investigation on the Effect of Preheating and Deposition Material Type on the Residual Stress in a Rail Repaired via Laser Metal 3D Printing, submitted to the Journal of Additive Manufacturing, September 2020. (UNLV)

#### *Presentations*

1. Zarembski, A.M., Effect of Tie Condition Distribution on Life Expectancy of Wood Crosstie, American Railway Engineering Association Annual Conference, virtual conference, September 2020.

#### **Semi-Annual Report (10/01/19 - 3/31/2020)**

#### *Publications*

1. Mast, T., Neighborgall, C., Peterson, A., Holton, C., and Ahmadian, M., Sensor Selection Consideration for Top-of-Rail (TOR) Lubrication Detection, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. The conference was postponed to 2021 due to COVID-19 social and travel restrictions. (Virginia Tech)



2. Radmehr, A., Ahangarnejad, A.H., Tajaddini, A., and Ahmadian, M., Surface Profile and Third-body Layer Accumulation Measurement Using a 3D Laser profiler, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. The conference was postponed to 2021 due to COVID-19 social and travel restrictions. (Virginia Tech)
3. Afzalan, M., Jazizadeh, F. K., and Ahmadian, M., Towards Railway Automated Defect Detection from Onboard Data using Deep Learning, Proceedings of the 2020 Joint Rail Conference, St. Louis, Mo, April 20-21, 2020. The conference was postponed to 2021 due to COVID-19 social and travel restrictions. (Virginia Tech)
4. Radmehr, A., Ahangarnejad, A.H., Tajaddini, A., and Ahmadian, M., Influence of Angle of Attack on Wheel-rail Interface (WRI) Dynamics Under Various Friction Conditions, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. The conference was postponed to 2021 due to COVID-19 social and travel restrictions. (Virginia Tech)
5. Tan, Y., Hosseini, S-M, Chen, Y., and Ahmadian, M., Simulation Evaluation of Fouled Ballast Thermal Characteristics, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. The conference was postponed to 2021 due to COVID-19 social and travel restrictions. (Virginia Tech)
6. Dama, N. and Ahmadian, M., Discrete Element Modeling of Railway Ballast for Studying Railroad Tamping Operation,” Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. The conference was postponed to 2021 due to COVID-19 social and travel restrictions. (Virginia Tech)
7. Hosseini, S-M, Tan, Y., and Ahmadian, M., Forward-Looking Infrared Radiometry (FLIR) Application for Detecting Ballast Fouling,” Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. The conference was postponed to 2021 due to COVID-19 social and travel restrictions. (Virginia Tech)
8. Radmehr, A., Ahangarnejad, A.H., Pan, Y., Tajaddini, A., and Ahmadian, M., Wheel-Rail Contact Patch Geometry Measurement and Shape Analysis Under Various Loading Conditions, Proceedings of the 2020 Joint Rail Conference, St. Louis, MO, April 20-21, 2020. The conference was postponed to 2021 due to COVID-19 social and travel restrictions. (Virginia Tech)
9. Lasisi, A, Merheb, A, Zarembski, A.M., and Attoh-Okine, N., Rail Track Quality and T-Stochastic Neighbor Embedding for Hybrid Track Index, Proceedings of IEEE Big Data 2019 Conference, Los Angeles, CA, December 2019. (University of Delaware)
10. Alsahli, A, Zarembski, A.M., Palese, J. and Euston W., Investigation of the Correlation between Track Geometry Defect Occurrence and Wood Tie Condition, Journal of Transportation Infrastructure Geotechnology, pp. 226-244 Vol. 6, Issue 3, September 2019. (UNLV)
11. Mortazavian, E., Wang, Z. and Teng, H., Repair of light rail track through restoration of the worn part of the railhead using submerged arc welding process. Accepted for publication in the International Journal of Advanced Manufacturing Technology, March 2020.. (UNLV)

### *Presentations*

1. Attoh-Okine, N., Application of Data Analytics to Railway Maintenance, Conference of Big Data in Railway Maintenance 2019, December 11-12, 2019. (University of Delaware)



2. Palese, J., Application of Data Analytics to Rail Wear Forecasting, Conference of Big Data in Railway Maintenance 2019, December 11-12, 2019. (University of Delaware)
3. Zarembski, A.M., Probabilistic Relationship for Development of a Severe Track Geometry Defect based on Ballast Condition as Measured by GPR, Conference of Big Data in Railway Maintenance 2019, December 11-12, 2020. (University of Delaware)
4. Lasisi, A, Merheb, A, Zarembski, A.M. and Attoh-Okine, N., Rail Track Quality and T-Stochastic Neighbor Embedding for Hybrid Track Index” IEEE Big Data 2019 Conference, Los Angeles, CA, December 2019. (University of Delaware)
5. Ashley, G. and Attoh-Okine, N.O. Approximate Bayesian Computation for Railway Geometry Modeling, Transportation Research Board Annual Meeting, Washington D.C., 2020. (University of Delaware).
6. Zarembski, A.M., Yurlov, D, Palese, J. W. and Attoh-Okine, N., Determination of Probability of a Track Geometry Defect based on GPR Measured Subsurface Conditions Using Data Analytics, 2019 World Congress of Railway Research, Tokyo, Japan, .October 28- November 1, 2019. (University of Delaware)
7. Dai, A., Zhu, M., Jiang, Y., and Teng, H., Development of UAV-based Rail Track Irregularity Monitoring and Measuring Platform, Fall Transportation Conference, Las Vegas, Nevada, October 31, 2019. (UNLV)
8. Ghafoori, N. and Hasnat A., Non-Proprietary Ultra High-Performance Concrete for Ballast-Track High Speed Railroad Sleepers, Fall Transportation Conference, Las Vegas, Nevada, October 31, 2019. (UNLV)
9. Schill, R., Transit Degradation Monitoring and Failure Prediction of Carbon Insert (Strip) in Pantograph Shoe, Fall Transportation Conference, Las Vegas, Nevada, October 31, 2019. (UNLV)

#### *Magazine articles*

1. Zarembski, A. M., Big Data in Railroad Maintenance Management: The Railroad Industry Continues to Make Use of Big Data, Railway Age, March 2020. (University of Delaware)

#### **Semi-Annual Report (4/01/19 to 9/30/19)**

#### *Journal publications*

1. Palese, J. W. and Zarembski, A. M., Methods for Aligning Near Continuous Railway Track Inspection Data, Proceedings of the Intuition of Mechanic Engineering, Part F: Journal of Rail and Rapid Transit, pp. 1-13, July 2019, DOI: 10.1177/0954409719860718207. (University of Delaware)
2. Lasisi, A. and Attoh-Okine, N. An Unsupervised Learning Framework for Track Quality Index and Safety, Journal Transportation Infrastructure and Geotechnology, pp. 1-12, July 2019. (University of Delaware)
3. Lasisi, A. and Attoh-Okine, N., Machine Learning Ensembles and Rail Defects Prediction: A multi-layer Stacking Methodology, ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering, 2019. (University of Delaware)

4. Palese, J.W., Zarembski, A.M., and Ebersole, K., Stochastic Analysis of Transit Wheel Wear and Optimized Forecasting of Wheel Maintenance Requirements, Proceedings of the 2019 Joint Rail Conference, JRC2019, April 9-12, 2019, Snowbird, Utah. (University of Delaware)
5. Lasisi, A., Li, P. and Attoh-Okine, N., Risk Assessment Framework for Train Accidents in the United States: A Case Study of California Rail Network (2008-2017)” AREMA Railway Interchange Conference, Minneapolis, MN, September 2019. (University of Delaware)
6. Mortazavian, E., Wang, Z., and Teng, H., Repair of Rail Track through Restoration of the Worn Part of the Railhead Using Submerged Arc Welding Process, written for the Journal of Wear, September, 2019. (UNLV)
7. Ghafoori, N. and Hasnat A., Properties of Ultra-high-performance Concrete, paper 5112, pp. 1-7, Fifth International Conference on Sustainable Construction Materials and Technologies, London, UK, July 14-17, 2019. (UNLV)

*Conference abstracts submitted*

1. Considerations for sensor selection for detecting Top-OF-Rail (TOR) Lubrication, ASME 2020 Joint Rail Conference, April 20-22, 2020, St. Louis, MO. (Virginia Tech)
2. Lessons Learned from Development of Optical Sensors for Top-of-Rail (ToR) Lubricity Condition Monitoring, ASME 2020 Joint Rail Conference, April 20-22, 2020, St. Louis, MO. (Virginia Tech)
3. Simulation Evaluation of Fouled Ballast Thermal Characteristics, ASME 2020 Joint Rail Conference, April 20-22, 2020, St. Louis, MO. (Virginia Tech)
4. Discrete Element Modeling of Railway Ballast for Studying Railroad Tamping Operation, ASME 2020 Joint Rail Conference, April 20-22, 2020, St. Louis, MO. (Virginia Tech)
5. Surface Profile and Third-Body Layer Accumulation Measurement Using a 3D Laser Camera, ASME 2020 Joint Rail Conference, April 20-22, 2020, St. Louis, MO. (Virginia Tech)
6. Influence of Angle of Attack on Wheel-Rail Interface (WRI) Dynamics, ASME 2020 Joint Rail Conference, April 20-22, 2020, St. Louis, MO. (Virginia Tech)
7. Forward-Looking Infrared Radiometry (FLIR) Application for Detecting Ballast Fouling, ASME 2020 Joint Rail Conference, April 20-22, 2020, St. Louis, MO. (Virginia Tech)
8. Rail Track Quality and T-Stochastic Neighbor Embedding for Hybrid Track Index, accepted to IEEE Big Data 2019 Conference, December 2019, Los Angeles, CA. (University of Delaware)
9. Development of UAV-based rail track irregularity monitoring and measuring platform, the Fall Transportation Conference, October 31, 2019, Las Vegas, NV. (UNLV)
10. Non-Proprietary Ultra High-Performance Concrete for Ballast-Track High Speed Railroad Sleepers, the Fall Transportation Conference, October 31, 2019, Las Vegas, NV. (UNLV)
11. Transit Degradation Monitoring and Failure Prediction of Carbon Insert (Strip) in Pantograph Shoe, the Fall Transportation Conference, October 31, 2019, Las Vegas, NV. (UNLV)

*Presentations*

1. Palese, J.W., Zarembski, A.M., and Ebersole, K., Stochastic Analysis of Transit Wheel Wear and Optimized Forecasting of Wheel Maintenance Requirements, Presentation at the 2019 Joint Rail Conference, JRC2019, April 9-12, 2019, Snowbird, Utah. (University of Delaware)

2. Lasisi, A., Li, P. and Attoh-Okine, N., Risk Assessment Framework for Train Accidents in the United States: A Case Study of California Rail Network (2008-2017), Presentation at the AREMA Railway Interchange Conference, Minneapolis, MN. September 2019. U (University of Delaware)

#### *Magazine articles*

1. Zarembski, A. M., The Evolution of Data Analytics and its Potential for Safety, Railway Age, April 2019. (University of Delaware)
2. Zarembski, A. M., Big Data in Railroad Maintenance; Application of Data Analytics in Railroad Track Maintenance, Railway Track & Structures, March 2019. (University of Delaware)

#### **Semi-Annual Report (10/01/18 to 3/31/19)**

#### *Journal publications*

1. Yurlov, D., Zarembski, A.M., Attoh-Okine, N., and Palese, J.W., Combinational Hybrid Analysis Approach to the Determination of a Probability Model for Development of Track Geometry Defects as a Function of Ground Penetrating Radar Measurements, accepted by Journal of Transportation Infrastructure Geotechnology, November 2018. (University of Delaware)
2. Lasisi, A. and Attoh-Okine, N., Network-level Infrastructure Management Tool for Rail Defect Prediction and Maintenance: An Ensemble Learning Methodology. 2019 Transportation Research Board Annual Meeting, DC (Accepted for presentation). (University of Delaware)
3. Zarembski, A.M., The Increasing Use of Data Analytics and Big Data in Railroad Maintenance Management, Railway Age, February 2019. (University of Delaware)
4. Lassi, A., Machine Learning: An Alternative to Weibull Defect Analysis of Rail Infrastructure, presented at the 2018 IEEE International Conference on Big Data (Big Data), Seattle WA, December 2018. (University of Delaware)
5. Attoh-Okine, N., keynote address, The Future of Blockchain Technology in Railway Track Engineering, presented in the 2018 Big Data in Railroad Maintenance Conference, Newark DE, December 2018. (University of Delaware)
6. Palese, J., Application of Data Analytics to Rail Wear Forecasting presented in the 2018 Big Data in Railroad Maintenance Conference, Newark DE, December 2018. (University of Delaware)
7. Palese, J.W., Zarembski, A.M., and Ebersole, K., Stochastic Analysis of Transit Wheel Wear and Optimized Forecasting of Wheel Maintenance Requirements, Proceedings of the 2019 Joint Rail Conference, JRC2019, April 9-12, 2019, Snowbird, UTAH, US. (University of Delaware)
8. Lasisi, A., Martey, E., Guilloty, D., and Attoh-Okine, N., Three-step Agglomerated Machine Learning: An alternative to Weibull Defect Analysis of Rail Infrastructure, 2018 IEEE International Conference on Big Data (Big Data), Seattle, WA, December 2018. (University of Delaware)
9. Zarembski, A.M., Yurlov, D., Palese, J.W., and Attoh-Okine, N., Determination of Probability of a Track Geometry Defect based on GPR Measured Subsurface Conditions Using Data

Analytics, accepted by 2019 World Congress of Railway Research, October 2019, Tokyo, Japan. (University of Delaware)

10. Li, H., Chen, T., Teng, H., and Jiang, Y., A Graph-Based Reinforcement Learning Method with Converged State Exploration and Exploitation, *Computer Modeling in Engineering Sciences*, vol. 118, no. 2, pp. 253-274, February 2019, DOI: 10.31614/cmescs.2019.05807. (UNLV)
11. Mortazavian, E., Wang, Z., and Teng, H., Thermal-Mechanical Study of 3D Printing Technology for Rapid Rail Repair, Oral presentation at and the proceeding of the ASME 2018 International Mechanical Engineering Congress and Exposition, IMECE 2018, November 9-15, 2018, Pittsburgh, PA. (UNLV)

#### *One-time publications*

*Poster presentations* at Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018:

1. Fundamental Study on the Rolling Contact Fatigue (RCF) at the Microstructural Level (Virginia Tech)
2. Advanced Modeling of Railway Ballast for Improving Railroad Tamping Operation (Virginia Tech)
3. Monitoring and Detecting Fouled Ballast Using Forward Looking Infrared Radiometer (FLIR) Technology (Virginia Tech)
4. The Application of Laser Technology for Railroad Top of Rail (TOR) Friction Modifier Detection and Measurements (Virginia Tech)
5. Towards Automated Monitoring of Track Using Machine Learning (Virginia Tech)
6. VT-FRA Roller Rig: Designed and Commissioned to Serve the Railroad Industry (Virginia Tech)
7. Analysis of Wheel Wear & Forecasting of Wheel Life for Transit Rail Operations, (University of Delaware)
8. Mobile 3D Printing of Rail Track Surface for Rapid Repairment (UNLV)
9. Developing Acoustic Technology to Detect Transverse Defects in Rail at High-speed (UNLV)
10. Non-Proprietary Ultra High-Performance Concrete for Ballast-Track High-speed Railroad Sleepers (UNLV)
11. UAV Applications to Track Inspection of Irregularity Measurement (UNLV)
12. Development of a Platform to Enable Real time, Non-Disruptive Testing and Early Fault Detection of Critical High Voltage Transformers and Switchgears in High-speed Rail (UNLV)
13. High-speed Rail Access Charge for the XpressWest of Nevada (UNLV)
14. Corrosion Prevention of the Rail Tie Plate for High-speed Rail Applications (UNLV)

*Presentations at the* Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018:

1. Keynote Lecture: Railroad Track Monitoring Technologies (Virginia Tech)
2. Qualitative Assessment of Rail Lubricity (Virginia Tech)
3. Developing Machine Learning Methods for Facilitated Track Condition Assessment Using Repeated Inspection Data (Virginia Tech)

*Journal paper submitted:*

1. Alsahli, A., Zarembski, A.M., Palsese, J., and Euston W., Investigation of the Correlation between Track Geometry Defect Occurrence and Wood Tie Condition, submitted to Journal of Transportation Infrastructure Geotechnology, January 2019 (University of Delaware)
2. Mortazavian, E., Wang, Z., and Teng, H., Thermal-kinetic-mechanical Modeling of Laser Powder Deposition Process for Rail Repair, Journal of Manufacturing Science and Engineering, March 2019 (UNLV)

*Conference abstracts submitted:*

1. Monitoring and Detecting Fouled Ballast using Forward Looking Infrared Radiometer (FLIR) Aerial Technology – Possibilities and Limitations (Virginia Tech)
2. Development of Vertical Force Control System for the Virginia Tech – Federal Railroad Administration Roller Rig (Virginia Tech)
3. Evaluating the Effect of Natural Third Body Layers on Friction Using the Virginia Tech Roller Rig (Virginia Tech)
4. Virginia Tech-Federal Railroad Administration Roller Rig Measurement Capabilities and Baseline Measurements (Virginia Tech)
5. Studying the effect of tangential forces on rolling contact fatigue in rails considering microstructure (Virginia Tech)
6. Automated Monitoring of Track through Historical Data Analysis (Virginia Tech)
7. Rail Defect Detection Technology: A Review of the Past and a Look to the Future, (UNLV)
8. Thermal-kinetic-mechanical Modeling of Laser Powder Deposition Process for Rail Repair (UNLV)

**Semi-Annual Report (4/1/18 to 9/30/18)**

*Publications:*

1. Ghodrati, M., Ahmadian, M., Mirzaeifar R., “Modeling of Rolling Contact Fatigue in Rails at the Microstructural Level,” *Wear*, accepted, in print. (Virginia Tech)
2. Taheri, M. A., Peterson, Munoz, J. E., and Ahmadian, M., "Railway Track Irregularity and Curvature Estimation Using Doppler LIDAR Fiber Optics," *Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit*, Vol 232, Issue 1, January 2018, pp. 63 – 72. (Virginia Tech)
3. Hosseinipour, M., Naderi-Soorki, M., and Ahmadian, M., “On Effective Electromagnetic Shielding of Modern Pulse Width Modulating Adjustable Speed Drives,” *IEEE Transaction on Electromagnetic Compatibility*, Vol. 60, Issue 4, October 2017, pp. 875 – 884. (DOI: <https://doi.org/10.1109/TEMC.2017.2738840>) (Virginia Tech)
4. Martey, E. N. and Attoh-Okine, N.O. (2018). “Modeling tamping recovery of track geometry using the copula based approach.” *Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit*, 0(0), 1–18. DOI: 10.1177/0954409718757556 (University of Delaware)

5. Zarembski, A. M., “Using Data Science to Establish Relationships between Key Railroad Engineering Parameters and Behavior”, Trends Tech Sci Res. 2018; 1(1): 555552 (University of Delaware)
6. Zarembski, A. M., “Better Railroading through Big Data” (The Emerging Role of Data Science in Railroad Maintenance Management), Railway Age, May 2018. (University of Delaware)
7. Zarembski, A. M., “Rolling with Big Data” (“Big Data and its Application in Rolling Stock Maintenance Management”), Railway Age, June 2018. <https://www.railwayage.com/analytics/rolling-with-big-data/> (University of Delaware)
8. Zarembski, A. M., Yurlov, D., Palese J. W., Attoh-Okine N, and Thompson, H, “Relationship between Track Geometry Degradation and Subsurface Condition as Measured by GPR”, American Railway Engineering Association Annual Conference, Chicago, IL, September 2018 (University of Delaware)
9. Palese, J. W., Zarembski, A. M. and Attoh-Okine,N, “ Development and Application of a Next Generation Rail Wear Model”, American Railway Engineering Association Annual Conference, Chicago, IL, September 2018 (University of Delaware)
10. Palese, J. W. and Zarembski, A. M., “Methods for Aligning Near Continuous Railway Track Inspection Data”, submitted to Proc IMechE Part F: Journal of Rail and Rapid Transit, July 2018 (University of Delaware)
11. E. Mortazavian, Z. Wang, and H. Teng, Thermal-Mechanical Study of 3D Printing Technology for Rapid Rail Repair, accepted for the Proceedings of the ASME 2018 International Mechanical Engineering Congress and Exposition, IMECE 2018, November 9-15, 2018, Pittsburgh, PA, USA. (UNLV)

### *Presentation*

1. Keynote Lecture: Railroad Track Monitoring Technologies, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018. (Virginia Tech)
2. Qualitative Assessment of Rail Lubricity, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018. (Virginia Tech)
3. Developing Machine Learning Methods for Facilitated Track Condition Assessment using Repeated Inspection Data, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018. (Virginia Tech)
4. Investigating the rolling contact fatigue in rails using finite element method and cohesive zone approach, Proceedings of the ASME Joint Rail Conference, Pittsburg, PA, April 17 – 19, 2018. (Virginia Tech)
5. Fundamental Study on The Rolling Contact Fatigue (RCF) at The Microstructural Level *the Rail Lubricity, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018:* (Virginia Tech)
6. Advanced Modeling of Railway Ballast for Improving Railroad Tamping Operation (*the Rail Lubricity, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018:* Virginia Tech)
7. Monitoring and Detecting Fouled Ballast using Forward Looking Infrared Radiometer (FLIR) Technology *the Rail Lubricity, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018:* (Virginia Tech)

8. The Application of Laser Technology for Railroad Top of Rail (TOR) Friction Modifier Detection and Measurements *the Rail Lubricity, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018*: (Virginia Tech)
9. Towards Automated Monitoring of Track Using Machine Learning *the Rail Lubricity, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018*: (Virginia Tech)
10. VT-FRA Roller Rig: Designed and Commissioned to Serve the Railroad Industry *the Rail Lubricity, Railroad Infrastructure Diagnosis and Prognosis Symposium, Las Vegas, Nevada, October 16 – 17, 2018*: (Virginia Tech)
11. Machine Ensemble and Rail Defect Prediction A Multilayer Stacking Methodology- A. Lasisi and N. Attoh-Okine AREMA 2018 – Poster AREMA; September, 2018 (University of Delaware)
12. Analysis of Wheel Wear & Forecasting of Wheel Life for Transit Rail Operations, K. Ebersole UNLV UTC Conference October 2018 (University of Delaware)
13. “Development and Application of a Next Generation Wear Model” Paper and Presentation AREMA; September, 2018 (University of Delaware)
14. “Relationship Between Track Geometry Degradation and Subsurface Condition as Measured by GPR” paper and presentation, AREMA; September, 2018 (University of Delaware)
15. “Machine Ensemble and Rail Defect Prediction. A Multilayer Stacking Methodology” - A. Lasisi and N. Attoh-Okine AREMA 2018 (University of Delaware)
16. “Bivariate Severity Analysis of Train Derailments Using Copula-Based Regression Models” - AISIM 2018 (E. N. Martey and Nii Attoh-Okine)- presentation - University of Delaware, Annual Inter-University Symposium on Infrastructure Management (AISIM) August 2018 (University of Delaware)
17. “Machine Learning Ensemble and Track Defect Prediction: A Multilayer Stacking Methodology” - A. Lasisi and N. Attoh-Okine –AISIM 2018- presentation –University of Delaware, Annual Inter-University Symposium on Infrastructure Management (AISIM) August 2018 (University of Delaware)
18. Modeling Taping Recovery of Track Geometry Using Copula Based Approach -UD Graduate Seminar- Department of Civil and Environmental Engineering, University of Delaware(University of Delaware)
19. E. Mortazavian and Z. Wang, Mobile 3D Printing of Rail Track Surface for Rapid Repairment, Oral Presentation – presented at the Seminar in Railroad Infrastructure, Las Vegas, NV. June 26, 2018. (UNLV)
20. Nader Ghafoori, Non-Propriety Ultra High-Performance Concrete for Ballast-Track High Speed Railroad Sleepers. Seminar – presented at the Seminar in Railroad Infrastructure, Las Vegas, NV. June 26, 2018. (UNLV)
21. Yingtao Jiang, UAV Applications to Track Inspection of Irregularity Measurement, Oral Presentation – presented at the Seminar in Railroad Infrastructure, Las Vegas, NV. June 26, 2018. (UNLV)

#### *Conference abstracts*

1. Monitoring and Detecting Fouled Ballast using Forward Looking Infrared Radiometer (FLIR) Aerial Technology – Possibilities and Limitations *the 2019 ASME Joint Rail Conference* (Virginia Tech)



2. Development of Vertical Force Control System for the Virginia Tech – Federal Railroad Administration Roller Rig *the 2019 ASME Joint Rail Conference* (Virginia Tech)
3. Evaluating the Effect of Natural Third Body Layers on Friction Using the Virginia Tech Roller Rig *the 2019 ASME Joint Rail Conference* (Virginia Tech)
4. Virginia Tech-Federal Railroad Administration Roller Rig Measurement Capabilities and Baseline Measurements *the 2019 ASME Joint Rail Conference* (Virginia Tech)
5. Studying the effect of tangential forces on rolling contact fatigue in rails considering microstructure *the 2019 ASME Joint Rail Conference* (Virginia Tech)
6. Automated Monitoring of Track through Historical Data Analysis *the 2019 ASME Joint Rail Conference* (Virginia Tech)

### Semi-Annual Report (6/1/17 to 3/31/18)

#### *Publications:*

1. Hawthorne V. T., Hawthorne, K. L., and Ahmadian, M., “Railway Engineering,” Mark’s Standard Handbook for Mechanical Engineers, 12th Edition, Section 11.2, 2017. (Virginia Tech)
2. Hosseinipour, M., Naderi-Soorki, M., and Ahmadian, M., “On Effective Electromagnetic Shielding of Modern Pulse Width Modulating Adjustable Speed Drives,” IEEE Transaction on Electromagnetic Compatibility, Vol. 60, Issue 4, October 2017, pp. 875 – 884. (DOI: <https://doi.org/10.1109/TEMC.2017.2738840>) (Virginia Tech)
3. Ghodrati, M., Ahmadian, M., and Mirzaeifar, R., “Investigating the rolling contact fatigue in rails using finite element method and cohesive zone approach,” Proceedings of the 2018 ASME Joint Rail Conference, JRC2018, April 18-20, 2018, Pittsburgh, PA. (Virginia Tech)
4. Principal Component Analysis and Track Quality Index: A Machine Learning Approach, accepted at Elsevier Special Issue on Big Data in Railway Transportation, December 2017. (University of Delaware)
5. “Modeling tamping recovery of track geometry using the copula based approach.” Journal of Rail and Rapid Transit. (University of Delaware)
6. E. Mortazavian, Z. Wang, and H. Teng, Thermal-Mechanical Study of 3D Printing Technology for Rapid Rail Repair, accepted for the Proceedings of the ASME 2018 International Mechanical Engineering Congress and Exposition, IMECE 2018, November 9-15, 2018, Pittsburgh, PA, USA. (UNLV)

#### *Other publications, conference papers and presentations*

1. Three posters presented at TRB conference in Washington DC in January 2018. (University of Delaware)
2. 6 posters presented at UD Big Data in Railroad Engineering December 13-14, 2017(University of Delaware)
3. Paper on Principal Component Analysis in the evaluation of Track Quality Indices presented at the Annual Inter-University Symposium on Infrastructure Management, Purdue University, June 2017. (University of Delaware)

4. Paper on Track Geometry Big Data Analysis: A Machine Learning Approach presented by IEEE International Conference on Big Data, Boston Massachusetts, December 2017. (University of Delaware)
5. Seminar presentation on Principal Component Analysis and Track Quality Index: A Machine Learning Approach presented at Transportation and Civil Infrastructure Seminar, November, Fall 2017. (University of Delaware)
6. Poster presentation at Delaware Data Science Symposium, University of Delaware, May 2017. (University of Delaware)
7. E. Mortazavian and Z. Wang, Mobile 3D Printing of Rail Track Surface for Rapid Repairment, Oral Presentation – presented at the 27th Annual Fall Transportation Conference, Las Vegas, NV, October 12, 2017. (UNLV)
8. Choi, J. O., Sapkota, S., Kaseko, M. S., & Teng, H., High speed Rail Access Charge for the XpressWest of Nevada. Oral Presentation – presented at the 27th Annual Fall Transportation Conference, Las Vegas, NV, October 12, 2017. (UNLV)
9. Ryan Sherman, Developing Acoustic Technology to Detect Transverse Defects in Rail at High Speed, Oral Presentation – presented at the 27th Annual Fall Transportation Conference, Las Vegas, NV, October 12, 2017. (UNLV)
10. Yingtao Jiang, Development of a Platform to Enable Real Time, Non-Disruptive Testing and Early Fault Detection of Critical High Voltage Transformers and Switchgears in High-Speed Rail, Oral Presentation – presented at the 27th Annual Fall Transportation Conference, Las Vegas, NV, October 12, 2017. (UNLV)
11. E. Mortazavian and Z. Wang, Mobile 3D Printing of Rail Track Surface for Rapid Repairment, Oral Presentation – presented at the Seminar in Railroad Infrastructure, Las Vegas, NV. June 23, 2017. (UNLV)
12. Choi, J. O., Kaseko, M. S., and Teng, H. High Speed Rail Access charge for the XpressWest of Nevada. Seminar – presented at the Seminar in Railroad Infrastructure, Las Vegas, NV. June 23, 2017. (UNLV)
13. Ryan Sherman, Developing Acoustic Technology to Detect Transverse Defects in Rail at High Speed, Oral Presentation — presented at the Seminar in Railroad Infrastructure, Las Vegas, NV. June 23, 2017. (UNLV)
14. Yingtao Jiang, Development of a Platform to Enable Real Time, Non-Disruptive Testing and Early Fault Detection of Critical High Voltage Transformers and Switchgears in High Speed Rail, Oral Presentation – presented at the Seminar in Railroad Infrastructure, Las Vegas, NV. June 23, 2017. (UNLV)
15. E. Mortazavian and Z. Wang, Mobile 3D Printing of Rail Track Surface for Rapid Repairment, poster at the Railroad UTC Reception, Washington, D.C., January 2018.
16. Choi, J. O., Kaseko, M. S., and Teng, H. High speed rail access charge for the XpressWest of Nevada. Seminar – poster at the Railroad UTC Reception, Washington, D.C., January 2018. (UNLV)
17. Ryan Sherman, Developing Acoustic Technology to Detect Transverse Defects in Rail at High Speed, Oral Presentation — poster at the Railroad UTC Reception, Washington, D.C., January 2018. (UNLV)
18. Yingtao Jiang, Development of a Platform to Enable Real Time, Non-Disruptive Testing and Early Fault Detection of Critical High Voltage Transformers and Switchgears in High-Speed Rail, Oral Presentation – poster at the Railroad UTC Reception, Washington, D.C., January 2018. (UNLV)

**Semi-Annual Report (11/30/16 to 5/31/17)**

*Journal publications:*

1. S. Galvan-Nunez and N. Attoh-Okine. "A Threshold-Regression Model for Track Geometry Degradation," Submitted to Journal of Rail and Rapid Transit, 2017 (University of Delaware)

*Other publications, conference papers and presentations:*

1. Conference presentation: Nii Attoh-Okine, "Critical Analysis of Factors Contributing to Rail Safety and Derailments in the Era of Big Data" presentation at the Big Data Risk Analysis Symposium, The Institute of Railway Research and RSSB, UK, June 14, 2017, (University of Delaware)