

CURRICULUM VITAE

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ACADEMIC EDUCATION

BS The University of Tokyo, Tokyo, Japan
Civil Engineering, 2000
MS The University of Tokyo, Tokyo, Japan
Civil Engineering, 2002
Ph.D. University of Illinois at Urbana-Champaign, IL, USA
Civil and Environmental Engineering, 2007

AWARDS/FELLOWSHIPS

Fellowship Vodafone Graduate Fellowships, 2005/09-2006/07

Awards

2022 The Nishino Prize

2022 Best Teaching Award of Faculty of Engineering, the University of Tokyo

2021 Dean's award (Research) of Graduate School of Engineering, the University of Tokyo

2020 JSCE AI-Data-Science encouraging prize for the paper "Displacement estimation of nonlinear SDOF system under seismic excitation using Kalman filter for state-parameter estimation", Intelligence, Informatics and Infrastructure, 1(1), 2020.

2020 **ASCE Moisseiff Award** for the paper "Reproduction of Cable-Stayed Bridge Seismic Responses Involving Tower-Girder Pounding and Damage Process Estimation for Large Earthquakes," Journal of Bridge Engineering, 2018

2019 **Prize for Science and Technology (Development Category), The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology** for "Development of a high accuracy road condition evaluation technique using a smartphone", Ministry of Education, Culture, Sports, Science and Technology, Japan.

2010 JSCE annual incentive award for the paper "Smart Sensor Middleware Development for Dense Structural Vibration Measurement," Journal of Japan Society of Civil Engineers, 2009.

2007 **ASCE Raymond C. Reese Research Prize** for the paper “Structural Identification of a Nonproportionally Damped System and Its Application to a Full-Scale Suspension Bridge,” Journal of Structural Engineering, October 2005

2003 **Tanaka Prize** for the paper, “Identification of Non-proportionally Damped System Using Ambient Vibration Measurement and its Application to a Suspension Bridge”, Journal of Structural Mechanics and Earthquake Engineering, Japan Society of Civil Engineers, 2002

EXPERIENCES

2002 **Research Assistant**, The University of Tokyo

2002-2005 **Research Assistant**, University of Illinois at Urbana-Champaign

2006-2009 **Junior Assistant Professor**, The University of Tokyo

2009-2014 **Senior Assistant Professor**, The University of Tokyo

2014-2022 **Associate Professor**, The University of Tokyo

2022-Present **Professor**, The University of Tokyo

2009- Committee on Data Informatics of the Asia-Pacific Network of Centers for Research in Smart Structures Technology

2010 National Organizing Committee and Conference Operations Committee, World Conference on Structural Control and Monitoring

2012- Program Committee , Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems, SPIE conference.

2015 Secretariat of the Scientific Committee, IABSE NARA 2015

2017 The 13th International Workshop on Advanced Smart Materials and Smart Structures Technology, Chair.

2015- Chairperson of Subcommittee for Performance-based Maintenance and Monitoring, Committee on Steel Structure, Japan Society of Civil Engineers.

HP:

<https://scholar.google.com/citations?user=g3FtWkIAAAAJ&hl=ja>

https://www.researchgate.net/profile/Tomonori_Nagayama

<https://www.scopus.com/authid/detail.uri?authorId=16402555500>

PUBLICATION

Theses

Nagayama, T. (2007). “Structural Health Monitoring Using Smart Sensors,” Doctoral dissertation, University of Illinois at Urbana-Champaign, 2007

Nagayama, T. (2002). "Development and performance evaluation of reflection free multi-directional wave generator," Master's thesis, Dept. of Civil Engineering, University of Tokyo, Japan (in Japanese).

Nagayama, T. (2000). "Structural identification of non-proportionally damped system and application to a long suspension bridge." Graduation thesis, Dept. of Civil Engineering, University of Tokyo, Japan (In Japanese).

Refereed Journal paper

Wang, H., Nagayama, T., Kawakatsu, T., Takasu A. : A data-driven approach for Bridge Weigh-In-Motion from impact acceleration responses at bridge joints, *Structural Control and Health Monitoring*, 2023.
<https://doi.org/10.1155/2023/2287978>

Ogawa, D., Yang, Y., Nagayama, T., Kato, S., Hisazumi, K., Tominaga, T. "Load carrying capacity estimation of a belt conveyor support structure member based on cross-sectional vibration modes" , *Journal of Structural Engineering A, JSCE*, 69, pp345-355, 2023.
<https://doi.org/10.11532/structcivil.69A.345>

Nakamura, T., Su, D., Nagayama, T. "Numerical investigation for uncertainty on seismic response of the pier considering material properties and curing conditions", *Journal of Structural Engineering A, JSCE*, 68, pp192-201, 2022.
<https://doi.org/10.11532/structcivil.68A.192>

Ishihara, K., Yang, Y., Nagayama, T., Nakamura, T., Su, D. "Displacement response estimation based on measurement of acceleration response and nonlinear hysteresis model", *Journal of Structural Engineering A, JSCE*, 68, pp275-288, 2022. <https://doi.org/10.11532/structcivil.68A.275>

H Wang, T Nagayama.: Response spectrum model of vehicle dynamic load for the prediction of bridge vibration level due to single vehicle-passage, *Engineering Structures*, 260, 2022. <https://doi.org/10.1016/j.engstruct.2022.114180>

Yang, Y., Nagayama, T., Xue, K., Su, D., "Displacement Estimation of a Nonlinear SDOF System under Seismic Excitation Using an Adaptive Kalman Filter". *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, 8(1), 04021084.
<https://doi.org/10.1061/AJRUA6.0001213>

Wang, H, Nagayama, T, Su, D. "Static and dynamic vehicle load identification with lane detection from measured bridge acceleration and inclination responses", *Struct Control Health Monit.* 2021; 28(11):e2823.
<https://doi.org/10.1002/stc.2823>

Thiyagarajan, JS., Su, D., Tanaka, H., Zhao, B., Nagayama T. “Response based track profile estimation using observable train models with numerical and experimental validations”, *Smart Structures and Systems*, 27 (2), 267, 2021.

Yang, Y., Nagayama, T., “Structural system identification under seismic excitation via Markov chain Monte Carlo method”. *Intelligence, Informatics and Infrastructure*, 2(2), 34–45. https://doi.org/10.11532/jsceiii.2.2_34, 2021

Bao Y, Li J, Nagayama T, Xu Y, Spencer BF, Li H. “The 1st International Project Competition for Structural Health Monitoring (IPC-SHM, 2020): A summary and benchmark problem” *Structural Health Monitoring*. April 2021. doi:10.1177/14759217211006485

Kuno, H., Su, D., Nagayama, T. (2020) “Numerical investigation of unsupported sleeper detection method based on LSTM and Monte Carlo Dropout, *Intelligence, Informatics and Infrastructure*, 1(J1), pp.536-544 https://doi.org/10.11532/jsceiii.1.J1_536,

Yang, Y., NAGAYAMA, T., SU, D. (2020): Displacement estimation of nonlinear SDOF system under seismic excitation using Kalman filter for state-parameter estimation, *Intelligence, Informatics and Infrastructure*, 1(1) pp.1-10, https://doi.org/10.11532/jsceiii.1.1_1,

Xue, K., Nagayama, T., Zhao, B. (2020) “Road profile estimation and half-car model identification through the automated processing of smartphone data”, *Mech. Syst. Signal Process.* 142, 106722. <https://doi.org/10.1016/j.ymsp.2020.106722>

Iida, Y., Nagayama, T., Xue, K., Su, D., Mizutani, T. (2020) “Numerical analysis on an active control of the train induced vibration of a railway bridge”, *Journal of Structural Engineering A, JSCE*, 66A, pp.376-387 (in Japanese).

Kato,S., Nagayama, T., Wang, H., Su, D., Nishio,M. (2020) “BWIM for ordinary road traffic on a continuous steel box girder bridge using wireless accelerometers” *Journal of Japan Society of Civil Engineers, Ser. A1, JSCE*,76 (2), pp. 356-375, (in Japanese).

Yang, Y., Nagayama, T., Xue, K. (2020) “Structure system estimation under seismic excitation with an adaptive extended Kalman filter”, *Journal of Sound and Vibration*, doi: <https://doi.org/10.1016/j.jsv.2020.115690>

Yamaguchi, T., Mizutani, T., Nagayama, T. (2020) “Mapping subsurface utility pipes by 3-D convolutional neural network and Kirchhoff migration using GPR images”, *IEEE Transactions on Geoscience and Remote Sensing*, doi: 10.1109/TGRS.2020.3030079

Wang, H., Nagayama, T., and Su, D. (2019) “Estimation of dynamic tire force by measurement of vehicle body responses with numerical and experimental validation”, *Mechanical Systems and Signal Processing*, 123, pp.369-385. <https://doi.org/10.1016/j.ymssp.2019.01.017>

Rana, S., Nagayama, T., Hisazumi, K., and Tominaga, T. (2019) “Damage identification of a belt conveyor support structure based on cross - sectional vibration characteristics” *Structural Control and Health Monitoring*; e2349. <https://doi.org/10.1002/stc.2349>

Yamaguchi, T., Nagayama, T., and Su, D. (2019) “Simple and accurate estimation of road profile by a Kalman filter using dynamic response of a bicycle” *Journal of Japan Society of Civil Engineers, Ser. E1*, pp. 17-26, (in Japanese).

Nagayama, T., Zhao, B.Y., and Xue, K. (2019) “Half car model identification and road profile estimation using vibration responses of a running vehicle” *Journal of Japan Society of Civil Engineers, Ser. E1*, pp. 1-16, (in Japanese).

Wang, H., Chen, J., Nagayama, T. (2019) “Parameter identification of spring-mass-damper model for bouncing people,” *Journal of Sound and Vibration*, <https://doi.org/10.1016/j.jsv.2019.05.034>

Zhao, B., Nagayama, T., Xue, K. (2019) “Road profile estimation, and its numerical and experimental validation, by smartphone measurement of the dynamic responses of an ordinary vehicle,” *Journal of Sound and Vibration*, <https://doi.org/10.1016/j.jsv.2019.05.015>

Fujino, Y., Siringoringo, D.M., Ikeda, Y., Nagayama, T., Mizutani, T. (2019) “Research and implementations of structural monitoring for bridges and buildings in Japan—a review”, *Engineering*, <https://doi.org/10.1016/j.eng.2019.09.006>

Wang, H., Nagayama, T. (2019) “Two-step method for bridge modal mass identification using synchronously measured bridge and vehicle dynamic responses, “ *International Journal of Lifecycle Performance Engineering*, Vol.3 No.3/4, pp.233 - 256, <https://dx.doi.org/10.1504/IJLCPE.2019.103692>

Kuleli M, Nagayama T. (2019) “A robust structural parameter estimation method using seismic response measurements”, *Struct Control Health Monit*, 2019;e2475. <https://doi.org/10.1002/stc.2475>

Wang, H., Nagayama, T., Nakasuka, J., Zhao, B., and Su, D. (2018). “Extraction of bridge fundamental frequency from estimated vehicle excitation through a particle filter approach”, *Journal of Sound and Vibration*, 428, pp.44–58. <https://doi.org/10.1016/j.jsv.2018.04.030>

Nakasuka, J., Wang, H., and Nagayama, T. (2018) “Extraction of the bridge natural frequency based on road profile estimation using vehicle response measurement”, *Journal of Structural Engineering A, JSCE*, 64A, pp.325-332 (in Japanese).

Kato, S., Nagayama, T., Su, D., Hisazumi, K., and Tominaga, T. (2018) “Identification of a cross-sectional vibration mode of a belt conveyor support structure using acoustic loading”, *Journal of Structural Engineering A, JSCE*, 64A, pp.354-363 (in Japanese).

Takeda, T., Mizutani, T., Nagayama, T., and Fujino, Y. (2018) “Reproduction of Cable-Stayed Bridge Seismic Responses Involving Tower–Girder Pounding and Damage Process Estimation for Large Earthquakes”, *Journal of Bridge Engineering*, 24 (2), [https://doi.org/10.1061/\(ASCE\)BE.1943-5592.0001336](https://doi.org/10.1061/(ASCE)BE.1943-5592.0001336)

Sun, Z., Nagayama, T., Nishio, M., and Fujino, Y. (2017). “Investigation on a curvature - based damage detection method using displacement under moving vehicle.” *Structural Control and Health Monitoring*, e2044. <https://doi.org/10.1002/stc.2044>.

Zhao, B.Y., Nagayama, T., Toyoda, M., Makihata, N., Takahashi, M., and Ieiri, M. (2017) “Vehicle model calibration in the frequency domain and its application to large-scale IRI estimation”, *Journal of disaster research*, 12(3), pp. 446-455.

Nagayama, T. and Zhang C. (2017) “A numerical study on bridge deflection estimation using multi-channel acceleration measurement”, *Journal of Structural Engineering A, JSCE*, 63A, pp.209-215.

Nagayama, T., Reksowardojo, A.P., Su, D., and Mizutani, T. (2017) “Bridge natural frequency estimation by extracting the common vibration component from the responses of two vehicles”, *Engineering Structures*, 150, pp. 821-829. <https://doi.org/10.1016/j.engstruct.2017.07.040>

Wang, H., Nagayama, T., Zhao, B., and Su, D. (2017) “Identification of moving vehicle parameters using bridge responses and estimated bridge pavement roughness”, *Engineering Structures*, 153, pp.57-70. <https://doi.org/10.1016/j.engstruct.2017.10.006>

Suzuki, M., Nagayama, T., Ohara, S., and Morikawa, H. (2017) “Structural Monitoring Using Concurrent Transmission Flooding”, *the IEICE Transactions on Communications (Japanese Edition)*, J100-B,(12), pp952-960 (in Japanese).

Sugisaki, K., Ieiri, M., Kitahara, T., Nagayama, T., Kawamura, K., and Matsuda, H. (2017) “Monitoring Implementation Method for Infrastructure Management Innovation”, *Journal of Japan Society of Civil Engineers*, Ser. F3 (Civil Engineering Information Processing).

Zhao, B.Y., and Nagayama, T. (2017). "IRI estimation by the frequency domain analysis of vehicle dynamic responses." *Procedia Engineering* 188, pp9-16.

<https://doi.org/10.1016/j.proeng.2017.04.451>

Wang, H., Nagayama, T., and Su, D. (2017). "Vehicle parameter identification through particle filter using bridge responses and estimated profile." *Procedia Engineering* 188, pp64-71. <https://doi.org/10.1016/j.proeng.2017.04.458>

Kim, R. E., Li, J., Spencer, B.F. Jr., Nagayama, T., and Mechitov, K.A. (2016). "Synchronized sensing for wireless monitoring of large structures", *Smart Structures and Systems*, 18(5), pp 885-909

Sun, Z. Nagayama, T., Su, D., and Fujino, Y. (2016). "A damage detection algorithm utilizing dynamic displacement of bridge under moving vehicle." *Shock and Vibration*, 2016. <https://doi.org/10.1155/2016/8454567>.

Nakamura, N., Mizutani, T., and Nagayama, T. (2016). "Evaluation of Ultimate Strength of Railway Viaducts with Columns Reinforced with Spiral Rebars Using Nonlinear Dynamic Analysis." *Journal of Japan Society of Civil Engineers*, Ser. A1 (Structural Engineering & Earthquake Engineering (SE/EE)), *JSCE*, 72 (4), I_213-I_223(in Japanese).

Sun, Z. Nagayama, T., and Fujino, Y. (2016). "Minimizing noise effect in curvature-based damage detection." *Journal of Civil Structural Health Monitoring*, 6(2), pp 255-264.

Narazaki, Y., Nagayama, T., and Su, D. (2016). "Development of a stiffness reduction evaluation method for RC columns during earthquakes based on acceleration measurements." *Journal of Structural Engineering. A, JSCE*, Vol. 62A, pp.212-225(in Japanese).

Nakasuka, J., Mizutani, T., Yamamoto, Y., Uchida, M., Su, D., Nagayama, T., and Fujino, Y. (2016). "Analysis of large amplitude vibration mechanism of Shinkansen PRC girder bridges and the long-term trend of their structural characteristics." *Journal of Structural Engineering. A, JSCE*, Vol. 62A, pp.42-49(in Japanese).

Su, D., Sano, S., Tanaka, H., Nagayama, T., and Mizutani, T. (2016). "Train localization by mutual correction of acceleration and interior sound." *Journal of Structural Engineering. A, JSCE*, Vol. 62A, pp.571-584(in Japanese).

Hornarbakhsh, A., Nagayama, T., Rana, S., Tominaga, T. Hisazumi, K., and Kanno, R. (2015). "Damage identification of belt conveyor support structure using periodic and isolated local vibration modes", *Smart Structures and Systems*, 15(3), pp.787-806.

Su, D., Shimada, Y., and Nagayama, T. (2015). "Stress evaluation and fatigue prediction of a steel girder bridge incorporating vehicle-bridge interaction analysis", *Journal of structural engineering.A*, 61A(0), pp.451-462(in Japanese).

Takeda, T., Nagayama, T., Mizutani, T., and Fujino, Y. (2015). "Seismic response characterization of a curved rigid-frame bridge using three dimensional nonlinear dynamic analysis, *Journal of Japan Society of Civil Engineers*, 71(4), I_641-I_649(in Japanese).

Mizutani, T., Inomata, K., Fujino, Y., and Nagayama, T. (2015). "Experimental Studies on Accurate Estimation of Rainfall Intensity from Electric Field Fluctuation of Surface Wave Mode around Leaky Coaxial Cable." *IEICE TRANSACTIONS on Communications*, B 98 (12), pp.1289-1297(in Japanese).

Sung, S., Park, J., Nagayama, T., and Jung, H.J. (2014). "A multi-scale sensing and diagnosis system combining accelerometers and gyroscopes for bridge health monitoring." *Smart Materials and Structures* 23 (1), 015005.

Zou, Z., Nagayama, T., and Fujino, Y. (2014). "Efficient multi-hop communication for static wireless sensor networks in the application to civil infrastructure monitoring." *Structural Control and Health Monitoring*, 21 (4), pp.603-619.

Mizutani, T., Inomata, K., Tsujita, W., Honda, R., Fujino, Y., and Nagayama, T. (2014). "Real-Time Rainfall Detection by Analyzing Singularities of Communications Antenna Radiowave Fluctuations." *Journal of Japan Society Hydrology and Water Resources*, Vol. 27, No.5, pp.208-218(in Japanese).

Kuroiwa, T., Suzuki, M., Saruwatari, S., Nagayama, T., and Morikawa, H. (2013). "A multi-channel bulk data collection protocol for structural health monitoring using wireless sensor networks." *IEICE Transactions on Communications (Japanese Edition)*, Vol. J96-B No.2 pp.114-123 (in Japanese).

Mizutani, T., Fujino, Y., Inomata, K., Tsujita, W., and Nagayama, T. (2013). "Trial of Rainfall Detection by Multi-fractal Analysis from Fluctuation of Electric Field around A Leaky Coaxial Cable", *Journal of Japan Society Hydrology and Water Resources*, 26(5), PP.258-268 (in Japanese).

Su, D., Miwa A., Fujino, Y., and Nagayama, T. (2013). "Measurement and analysis of traffic-induced response of viaducts in Tokyo Metropolitan Expressway." *Journal of Structural Engineering. A, JSCE* Vol. 59A, pp.281-289 (in Japanese).

Dinh, H.M., Nagayama, T., and Fujino, Y. (2012). "Structural parameter identification by use of additional known masses and its experimental application." *Structural Control and Health Monitoring*, 19(3), pp436-450.

Jo, H., Sim, S.-H., Nagayama, T., and Spencer, Jr., B. F. (2012). "Development and application of high sensitivity wireless smart sensors for decentralized stochastic modal identification." *Journal of Engineering Mechanics*, 138(6), pp.683–694.

Asakawa, H., Nagayama, T., Fujino, Y., Nishikawa, T., Akimoto, T., and Izumi, K. (2012). "Development of a simple pavement diagnostic system using dynamic responses of an ordinary vehicle." *Journal of Japan Society of Civil Engineers, Ser. E1 (Pavement Engineering)*, 68 (1) pp.20-31 (in Japanese).

Siringoringo, D., Fujino, Y., and Nagayama, T. (2011). "Dynamic characteristics of an overpass bridge in a full-scale destructive test." *Journal of Engineering Mechanics*. <https://ascelibrary.org/doi/10.1061/%28ASCE%29EM.1943-7889.0000280>

Siringoringo, D., Fujino, Y., Nagayama, T., and Wenzel, H. (2011). "Vibration Characteristics of an Overpass Bridge During Full-Scale Destructive Testing." *Procedia Engineering* 14, pp.777-784.

Yun, G.J., Lee, S.-G., Carletta, J., and Nagayama, T. (2011). "Decentralized damage identification using wavelet signal analysis embedded on wireless smart sensors." *Engineering Structures*, 33(7), pp.2162-2172.

Nagayama, T., Moinzadeh, P., Mechitov, K.A., Ushita, M., Makihata, N., Ieiri, M., Agha, G.A., Spencer Jr., B.F., Fujino, Y., and Seo, J. (2010). "Reliable multihop communication for structural health monitoring," *Special Issue of Smart Structures and Systems on Wireless Sensor Advances and Applications for Civil Infrastructure Monitoring*, 6(5).

Sim, S.-H., Spencer, Jr., B. F., and Nagayama, T. (2010). "Multimetric sensing for structural damage detection." *Journal of engineering mechanics* 137 (1), pp.22-30.

Rice, J., Mechitov, K., Sim, S.-H., Nagayama, T., Jang, S., Kim, R., Spencer, Jr., B. F., Agha, G., and Fujino, Y. (2010). "Flexible smart sensor framework for autonomous structural health monitoring." *Special Issue of Smart Structures and Systems on Wireless Sensor Advances and Applications for Civil Infrastructure Monitoring*, 6(5).

Nagayama, T. Spencer, Jr., B. F., Mechitov, K. A., and Agha, G. A. (2009). "Middleware services for structural health monitoring using smart sensors." *Smart Structures and Systems*, 5(2), pp.119-137.

Nagayama, T., Spencer, Jr., B. F., and Fujino, Y. (2009). "Smart sensor middleware development for dense structural vibration measurement." *Journal of*

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Nagayama, T., Spencer, Jr., B. F., and Rice, J. A. (2009). "Autonomous decentralized structural health monitoring using smart sensors." *Structural Control and Health Monitoring*, 16, pp.842-859.

Su, D., Fujino, Y., Nagayama, T., Hernandez, J., and Seki, M. (2009). "Vibration of reinforced concrete viaducts under high-speed train passage: measurement and prediction including train-viaduct interaction." *Structure and Infrastructure Engineering: Maintenance, Management, Life-Cycle Design and Performance*, 1744-8980. <https://doi.org/10.1080/15732470903068888>

Cho, S., Yun, C.-B., Lynch, J. P., Zimmerman, A.T., Spencer, B. F., and Nagayama, T. (2008). "Smart wireless sensor technology for structural health monitoring of civil structures." *International Journal of Steel Structures*, 8(3), pp.267-275.

Nagayama, T. Sim, S-H., Miyamori, Y., and Spencer, Jr., B. F. (2007). "Issues in structural health monitoring employing smart sensors." *Smart Structures and Systems*, 3(3), pp. 299-320.

Ruiz-Sandoval, M. Nagayama, T., and Spencer, Jr., B. F. (2006). "Sensor development using Berkeley Mote platform." *Journal of Earthquake Engineering*, 10(2), 289-309.

Nagayama, T., Abe, M., Fujino, Y., and Ikeda, K. (2005). "Structural identification of non-proportionally damped systems and its application to a full-scale suspension bridge." *Journal of Structural Engineering*, 131(10), 1536-1545.

Nagayama, T., Abe, M., Fujino Y., and Ikeda, K. (2003). "Non-iterative identification of non-proportionally damped system from ambient vibration measurement and analysis of dynamic properties of a long span suspension bridge." *Journal of Structural Mechanics and Earthquake Engineering, JSCE*, 745, 155-169 (in Japanese).

Abe, M., Fujino, Y., Nagayama, T., and Vu-Manh H. (2002). "A non-iterative approach in vibration-based damage detection for a damped mechanical system." *Journal of Applied Mechanics, JSCE*, 5, 855-862 (in Japanese).

Nagayama, T., Sato, S., Isobe, M., and Tsuzuki, R. (2002). "Development and performance evaluation of reflection free multi-directional wave generator." *Proc., 49th Coastal Engineering, JSCE*, 11-15 (in Japanese).

be, M., Fujino, Y., Nagayama, T., and Ikeda, K. (2001). "Identification of non-proportionally damped system using ambient vibration measurement and its application to a suspension bridge", *Journal of Structural Mechanics and Earthquake Engineering, Japan Society of Civil Engineers*, 689, 261-274 (in Japanese).

Laboratory Report

Nagayama, T. and Spencer, Jr., B. F.(2007). "Structural health monitoring using smart sensors." *Newmark Structural Engineering Laboratory Report Series 001* <http://hdl.handle.net/2142/3521>,

Conference paper

T. Kawakatsu, K. Aihara, A. Takasu, J. Adachi, H. Wang and T. Nagayama, "Fully-Neural Approach to Vehicle Weighing and Strain Prediction on Bridges Using Wireless Accelerometers," *ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2021, pp. 8027-8031, doi: 10.1109/ICASSP39728.2021.9414433.

Nagayama, T., Kato, S., Wang, H., Su, D., and Nishio, M. (2019) "Automatic vehicle passage detection using wireless accelerometers toward Bridge Weigh-In-Motion", *Proc. of ANCRiSST 2019*, Rome, Italy.

Xue, K., Nagayama, T., and Su, D. (2019) "Road condition evaluation using smartphone based sensing and data assimilation techniques", *Proc. of 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure, St. Louis, USA*.

Nagayama, T., Kato, S., Wang, H., Su, D., and Nishio, M. (2019) "Vehicle weight estimation using wireless accelerometers on a steel-box girder bridge," *Proc. of 20th IABSE Congress*, pp.806-811.

Thiyagarajan,J.S., Su, D., Hirofumi Tanaka, H., Nagayama, T.(2018) "Track profile estimation using inverse analysis from multi body simulation approach", *Proc. of 7th World Conference on Structural Control and Monitoring, Qingdao, China*.

Kuleli, M., and Nagayama, T. (2018). "Sensitivity of stiffness condition assessment results to unscented Kalman filter initial parameters", *Proc. of 7th World Conference on Structural Control and Monitoring, Qingdao, China*.

Wang,H., and Nagayama, T. (2018). "Numerical study on dynamic tire force estimation from measurement of vehicle body responses", *Proc. of 7th World Conference on Structural Control and Monitoring, Qingdao, China*.

Nagayama, T., Zhang, C., Su, D., and Lee, S. (2018) “Estimation of a continuous girder bridge’s deflection using acceleration and inclination measurement”, *Proc. of 7th World Conference on Structural Control and Monitoring, Qingdao, China.*

Waqas,H.A., Su, D., and Nagayama, T. (2018) “Feasibility of In Situ Displacement and Acceleration Measurements to identify Bridge Steel Bearing Malfunction” , *Proc. of 7th World Conference on Structural Control and Monitoring, Qingdao, China.*

Mizutani. T., Yamaguchi. T., Sakaguchi. A., Tarumi. M., and Nagayama, T. (2018) “Advancement and accuracy evaluation of automatic damage detection algorithm for concrete bridge deck by ground penetrating radar”, *Proc. of 7th World Conference on Structural Control and Monitoring, Qingdao, China.*

Zhao, B.Y., Nagayama, T., and Su, D. (2017). “Road Profile Evaluation Using Multiple Dynamic Responses from Ordinary Vehicles”, *Proc of ANCRiSST 2017, Tokyo.*

Takeda, T., Mizutani, T., Nagayama, T., and Fujino, Y. (2017). “Reproduction of Tower-girder Pounding Response and Local Damage Evaluation of Long-span Bridge Using Multi-scale Model”, *Proc of ANCRiSST 2017, Tokyo.*

Kato,S., Nagayama,, Su, D., Hisazumi, K., and Tominaga,T (2017). “Identification of a Cross-sectional Vibration Mode of a Belt Conveyor Structure Using Acoustic Loading”, *Proc of ANCRiSST 2017, Tokyo.*

Thiyagarajan,J.S., Su, D., Tanaka,H., Zhao, B.Y., and Nagayama,T. (2017). “Inverse Analysis for Rail Track Profile Estimation from In-service Railway Vehicle”, *Proc of ANCRiSST 2017, Tokyo.*

Wang,H., Nagayama, T., and Su. D. (2017). “A Bridge Weigh-in-Motion Method by Moving Force Identification Using Augmented Particle Filter from Measured Bridge Acceleration and Inclination Data”, *Proc of ANCRiSST 2017, Tokyo.*

Kuleli, M., and Nagayama, T. (2017). “Identification of the Rubber Bearing Characteristics Using Aftershock Response Measurement of the Kumamoto Earthquake”, *Proc of ANCRiSST 2017, Tokyo.*

Nagayama, T., Suzuki, M., Zhang, C., and Su. D. (2017). “High-accuracy Wireless Sensor Development and Its Application to Deflection Estimation of a Steel Box Girder Bridge”, *Proc of ANCRiSST 2017, Tokyo.*

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INVITED LECTURES

Asia-Pacific-Euro Summer School on Smart Structures Technology, University of Illinois at Urbana-Champaign, USA (2009, 2015), The University of Tokyo, Japan (2010), Tongji University, China (2011), University of Cambridge, UK (2016), Yokohama National University, Japan (2017), Qingdao University of Technology, China (2018), Sapienza University of Rome, Italy (2019).

2008 ANCRiSST short course on smart wireless sensor technology and applications, Korean Advanced Institute of Science and Technology, Daejeon, Korea, Sept. 2008.

Shantou University, “Structural health monitoring using smart sensors” Mar. 2007.

Monitoring-based evaluation of bridges, online workshop on assessment, repair & rehabilitation of bridges, Indian Association of Structural Engineers, 2022.3.18.

Monitoring-based evaluation of bridges, 1st international webinar series on recent advancements in Enviro-Structural confluence, ASCE Indo-Sri Lanka Section, 2022.3.5

Monitoring-based evaluation of bridge, international workshop on smart and resilient bridges, ASCE student chapter of IIT Dhanbad, 2021.12.5.

Monitoring Taking Advantage of and Materialising Digital Twins, IABSE online 2020, 2020.9.3.

Infrastructure assessment based on IoT and data assimilation techniques, 2nd International Conference on Health Monitoring of Civil & Maritime Structures, Glasgow, UK, 2019.5.23.

Infrastructure monitoring taking advantage of IoT technology - from proof-of-concept to engineering problem applications -, ZHITU Symposium, 2018.7.12

CURRENT RESEACH TOPICS

Research to evaluate road and railway track conditions efficiently using vehicle dynamic responses: A smartphone-based Dynamic Response Intelligent Monitoring System (DRIMS) has been developed to conduct road evaluations with high efficiency and reasonable accuracy. DRIMS estimates the International Roughness Index (IRI) based on vehicle responses measured with an iOS application, which obtains three-axis acceleration, angular velocity, and GPS with accurate sampling timing; resampling based on the sampling theory is implemented. Employing the half car vehicle model together with the data assimilation technique, this response-based profile estimation method can perform even better than expensive conventional profilers depending on conditions. This development is now being extended to implementation involving a large number of commercial vehicles. Furthermore, computer-vision techniques have been employed to analyze drive recorder images to extract road distress such as potholes and cracks. A variety of resources and techniques of inexpensive nature are studied to enable efficient road condition evaluations.

Furthermore, not only the current road condition, but also future deterioration risks of road is studied. The record of road condition evaluations and traffic volume and weight information are integrated to evaluate the deterioration risks.

In addition to vehicle road network, the total length of bicycle road network is increasing; the evaluation and maintenance of bicycle road is becoming important issues. The road condition evaluation techniques are being extended to the bicycle roads.

The same approach is applied to railroad track evaluation. In cooperation with railway-related companies, we are estimating track conditions by inverse analysis of train movements, evaluating track deformations by computer-vision techniques, and developing inverse analysis algorithms through multi-body simulation.

<https://www.drims.online>

<https://doi.org/10.1016/j.ymsp.2020.106722>

<https://www.youtube.com/watch?v=8JswgBaFLn0>

<https://www.youtube.com/watch?v=09E7-P3KC2o>

Research to efficiently evaluate the condition of industry infrastructure: Belt-conveyors at iron works are an important industrial infrastructure supporting our economy. The support structures of belt conveyors are, however, experiencing degradation. The failure of these structures can result in operation stop of the whole iron works. While the need for condition assessment is clear, the assessment is not easily performed; due to safety concerns, hands-on inspections on the support structures are allowed during operations. The condition needs to be efficiently evaluated without interrupting the operation. Using vibration based structural assessment techniques, together with LDV and other sensors to remotely measure the target, the condition of the support structures are investigated. Specific local vibration modes, which are sensitive to structural

member damages, are identified and the load-carrying capacities of damaged members are assessed. We are developing remote diagnostic methods applicable to real structures by analyzing the vibration under non-contact excitation such as acoustic excitation and operational vibration.

We are also conducting research on the application of this technology to bridges and other structures, aiming at efficient maintenance and management of infrastructure.

<https://doi.org/10.11532/structcivil.64A.354>

<https://doi.org/10.1002/stc.2349>

Rapid post-earthquake assessment of structures: After large seismic events, quick assessment of critical transportation infrastructures is important. Numerical simulations and monitoring data analysis are studied to realize the quick assessment. Stiffness, hysteresis characteristics, and displacement are considered to be major structural characteristics to represent the structural conditions. These characteristics are evaluated using numerical models of structures and acceleration response monitoring data.

<https://doi.org/10.1061/AJRUA6.0001213>

Research to reveal the live load on road networks: Live load is one of major causes behind fatigues on the superstructures and pavement. However, the actual live load condition is not revealed in details. Weigh-In-Motion typically requires installation of sensors by burying sensors under the pavement; the traffic needs to be stopped. The installation is costly and time consuming, limiting the widespread use of WIM. A new Bridge Weigh-In-Motion using wireless accelerometers and camera based on only batteries, without the need of external power sources, are being studied to reveal the live load condition on large road networks.

https://doi.org/10.2208/jscejseee.76.2_356

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Research to comprehend structural condition and states through flexible monitoring using ad-hoc wireless sensor networks: When new materials and new construction methods are employed, monitoring has been often adapted to comprehend the condition and states to compensate for our shortage of knowledge. For maintenance of existing structures, those showing behavior/conditions different from the original design assumption become problematic. Original assumptions and simulation based on the assumptions cannot therefore address the issues. Comprehending the structural condition and states through monitoring become important. However, traditional monitoring techniques are costly and time consuming prohibiting flexible monitoring; physical quantities of interests of target structures are not necessarily obtainable. Wireless sensor networks with the capability of synchronized sensing and battery operation can potentially enable such flexible monitoring.

The use of wireless sensors for such flexible monitoring were however not practical. Communication distance was too short. Synchronization accuracy was

too poor. The battery life was too short. The measurement accuracy was too poor. Academic research on wireless monitoring was not practical solutions toward addressing engineering problems. New wireless sensors addressing all of these problems have been developed in collaboration with Morikawa laboratory, the University of Tokyo. The sensors have been utilized in seismic response monitoring, detailed dynamic problem investigation on a cable-stay bridge, easy-to-install Bridge Weigh-In-Motion, and other applications. The wireless sensors enable monitoring of physical quantities when and where needed, in flexible and ad-hoc manners. The monitoring, together with data assimilation techniques which integrate numerical model and a large amount of data, aims to clarify the loading, structural system performance, characteristics of system output such as vibration and deflection, as well as to provide feedback to the design and maintenance.

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