Assefa Jonathan Dereje

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Research Highlights

- **Expertise on seismic retrofit of existing RC structures** including experimental testing, numerical modeling, nonlinear seismic performance evaluation.
- **Implementation of optimization algorithms** for determining optimal design parameters in seismic retrofit, considering uncertainties and robustness.
- **Development of a ground motion selection algorithm** for site-specific ground motion records in nonlinear time history analysis.
- **Innovative hybrid damper design** combining metallic yielding and viscoelastic dampers to enhance seismic performance.

Education

Sungkyunkwan University, Suwon, South Korea
Combined M.s Ph.D. in Civil, Architectural and Environmental System Engineering, **expected Feb, 2014.**
Dissertation: "Machine learning-assisted seismic retrofit design and optimization framework"
Advisor: Professor Jinkoo Kim (President of Earthquake Engineering Society of Korea Mar, 2019- Feb, 2021)

Addis Ababa University, Addis Ababa, Ethiopia
B.SC in Civil Engineering, Jul, 2015
Thesis: "Software Development for the Structural Design of Structural Elements to the Ethiopian Building Code Standards"
Advisor: Melakou Seyoum

Professional Experiences

Structural Engineer **FasilGiorghisconsult Architects and Engineers**

Dec, 2015 - Feb, 2018

Structural Analysis and Design

- **Conducted structural analysis and design using software tools** such as SAP2000, ETABS and SAFE
- **Designed reinforced concrete structural elements** including beams, columns, slabs and foundations for residential, commercial and industrial projects.
- **Optimized steel roof system designs** to achieve efficient structural performance, considering factors such as span, loadings and deflection criteria, and architectural requirements.
- **Performing structural peer reviews** and providing technical guidance to design teams
- **Collaborating with contractors** to resolve constructability issues and provide field engineering support.

Department of Civil, Architectural and Environmental System Engineering, Sungkyunkwan University

Research assistant Mar, 2018– Feb, 2014

Seismic retrofit methods

- **Proposed seismic retrofit methods** such as self-centering post-tensioned precast concrete frames with friction dampers (SC-PC-FD) and hybrid dampers that combines a metallic yielding damper and a high-damping viscoelastic damper.
- **Conducted comprehensive experimental tests** to evaluate the effectiveness and performance of the retrofit methods.
- **Proposed and validated analytical models** of proposed seismic retrofit methods using the experimental results
- **Developed curve fitting algorithms** to calibrate analytical model parameters

Optimization applications

- **Applied optimization algorithms** to determine optimal design parameters for seismic retrofit projects
- **Developed customized optimization frameworks** considering various constraints and multiple objectives
- **Incorporated robustness and uncertainties** in the design process to improve the reliability of retrofit solutions
- **Utilized parallel processing** to reduce computational time **in the optimization framework**

Seismic response evaluation

- **Developed analytical models** that accurately capture the dynamic response and performance of retrofitted structures.
- **Utilized advanced analytical methods**, such as nonlinear time history analysis.
- **Investigated the seismic performance** of retrofitted structures **using IDA, and fragility analysis.**
- **Proposed a ground motion selection algorithm** incorporating a multi-objective optimization scheme enabling efficient selection of site-specific ground motion records for nonlinear time history analysis.

Works In Progress

- **Developing machine learning models** to predict hysteretic response of viscoelastic dampers
- **Utilizing machine learning models** to predict analytical model parameters of viscoelastic dampers
- **Utilizing explainable AI** to understand and interpret predictions of the developed machine learning models hysteretic response of viscoelastic dampers predictions

Publications

Google scholar profile: https://scholar.google.com/citations?user=sdTi7CsAAAAJ&hl

[1] **Dereje, A.J,** MM Javidan, Ahn,T.S. and Kim, J. Experimental and analytical study of a hybrid seismic damper made of butterfly-shaped steel plates and viscoelastic pads. *Journal of building engineering* **(Submitted)**

[2] **Dereje, A.J**. and Kim, J., 2023. An enhanced ground motion selection algorithm for seismic safety assessment of structures. *Soil Dynamics and Earthquake Engineering*, 165, p.107709.

[3] **Dereje, A.J.** and Kim, J., 2023. Robust seismic retrofit design framework for asymmetric soft-first story structures considering uncertainties. *Structural Engineering and Mechanics*, 86(2), pp.249-260.

[4] **Dereje, A.J.** and Kim, J., 2022. Optimal seismic retrofit design method for asymmetric soft first-story structures. *Structural Engineering and Mechanics*, 81(6), p.677.

[5] **Dereje, J.A.**, Eldin, M.N. and Kim, J., 2021. Seismic retrofit of a soft first story structure using an optimally designed post–tensioned PC frame. *Earthquakes and Structures*, 20(6), p.627.

[6] Eldin, M.N., **Dereje, A.J**. and Kim, J., 2020. Seismic retrofit of framed buildings using self-centering PC frames. *Journal of Structural Engineering*, 146(10), p.04020208.

[7] Eldin, M.N., **Dereje, A.J**. and Kim, J., 2020. Seismic retrofit of RC buildings using self-centering PC frames with friction-dampers. *Engineering Structures*, 208, p.109925.

Software patents

[1] J. Kim **Assefa Jonathan Dereje**, developers; Optimization tool for seismic retrofit using viscoelastic dampers (OTVED) (점탄성 댐퍼를 이용한 내진보강 최적설계 툴)". C-2022-031994 Aug 16, 2022.
https://www.cros.or.kr/

[2] J. Kim, **Assefa Jonathan Dereje**, developers; OSRAS: Optimization tool for Seismic Retrofit of Asymmetric Structures (비정형 구조물 내진보강 최적설계 툴)". C-2022-004491 Jan,11,2022.
https://www.cros.or.kr/

[3] J. Kim, **Assefa Jonathan Dereje**, developers: Piloti Structure Retrofit Optimization Tool (PSROT) (최적화기법을 이용한 필로티 구조물 내진보강 해석 툴)". C-2020-035792 Oct 16, 2020.
https://www.cros.or.kr/

Presentations

[1] **Dereje Jonathan** , Jun, Seungho, Kim, Jinkoo," Optimum quantity and locations of seismic retrofit devices based on multi-purpose optimization" *Proceedings of EESK Conference 2021*, South Korea, 2020.

[2] **Dereje Jonathan** , Jun, Seungho, Kim, Jinkoo "Seismic retrofit of Piloti-type structure using PC frame" *Proceedings of EESK Conference 2020*, South Korea, 2020.

Certifications and licenses

[1] Mathematics for Machine learning Specialization. Completed October1,2021. Coursera.org by Imperial College. https://coursera.org/share/804cba7004fcf97f297cdc885fae0fe5

[2] Object-Oriented Design. Completed February 20,2021 at Coursera.org by University of ALBERTA. https://coursera.org/share/d66e7de3da9cc1973e9f416a31dc8a06

[3] Introduction to Computer Science. Completed January 21,2015 at edx.org by Harvardx. https://verify.edx.org/cert/6023cac046db4e39a1bc50f2477fb709

[4] Mechanical Behavior of Materials. Completed December 19,2014 at edx.org by MITx. https://verify.edx.org/cert/9450a0eb3f784f10bcf94cb74de5ae77

Skills

- **Programming Languages:** Python, MATLAB, C++, JAVA
- **FEM software:** OpenSees, SAP2000, ETABS, SAFE, ABAQUS
- **CAD & BIM software:** SketchUp, AutoCad, Fusion360
- **Graphics software:** Adobe Illustrator
- **Language:** English (Professional Proficiency), Amharic (Native Proficiency)