

FINITE ELEMENT ANALYSIS OF THE SEISMIC RESPONSE OF A ROCKING PODIUM STRUCTURE

2019 PEER Blind Prediction Contest

Myron Chiyun Zhong PhD Candidate, University of Toronto

Constantin Christopoulos Professor, University of Toronto

Department of Civil & Mineral Engineering, University of Toronto

Introduction

Rocking podium structures are a type of self-centering base rocking system that isolates the superstructure from strong ground motion excitation by uplifting and rocking motion of free-standing columns at the base of the structure.

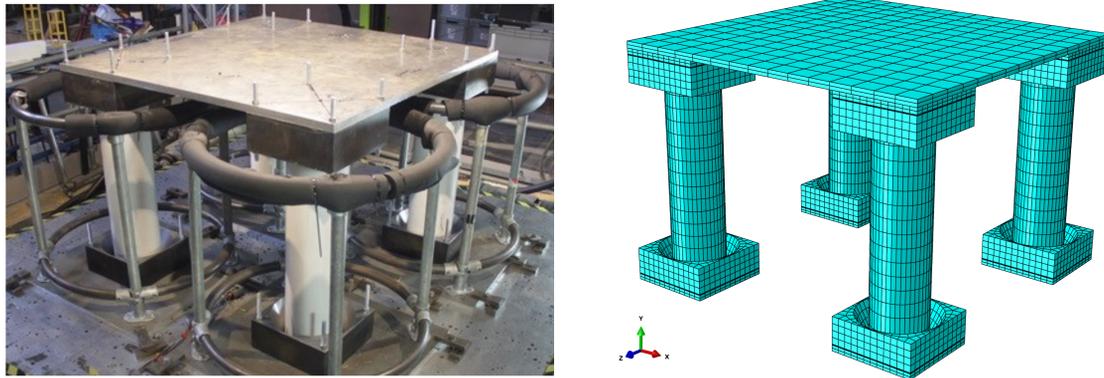


Figure 1. Rocking Podium Structure: (a) Test Specimen (PEER 2019), (b) Finite Element Model

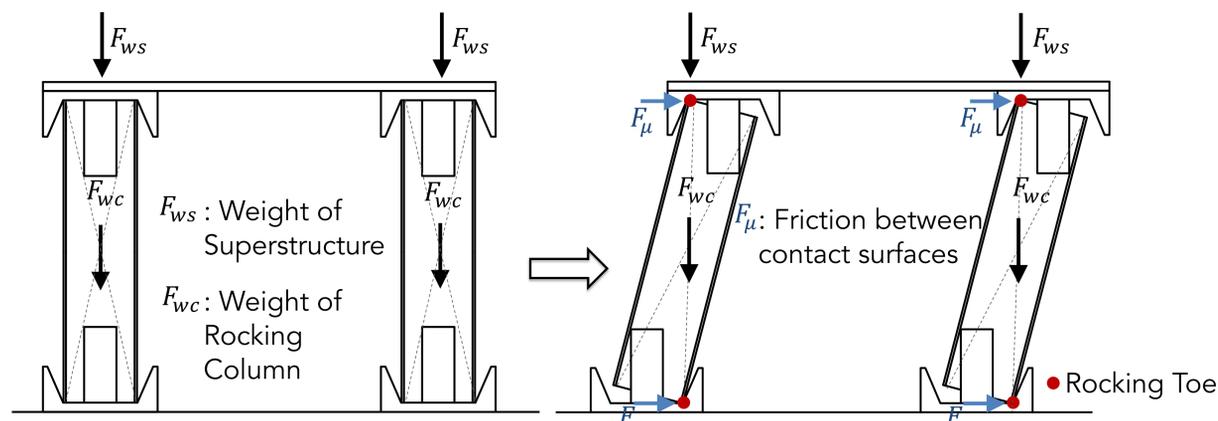


Figure 2. Rocking Podium Structure Schematics: (a) At Rest, (b) Rocking

Finite Element Modeling

Finite element (FE) analyses of this rocking podium structure were performed using ABAQUS 6.13 to simulate 3D dynamic responses of the tested specimen under 200 ground motions (GMs).

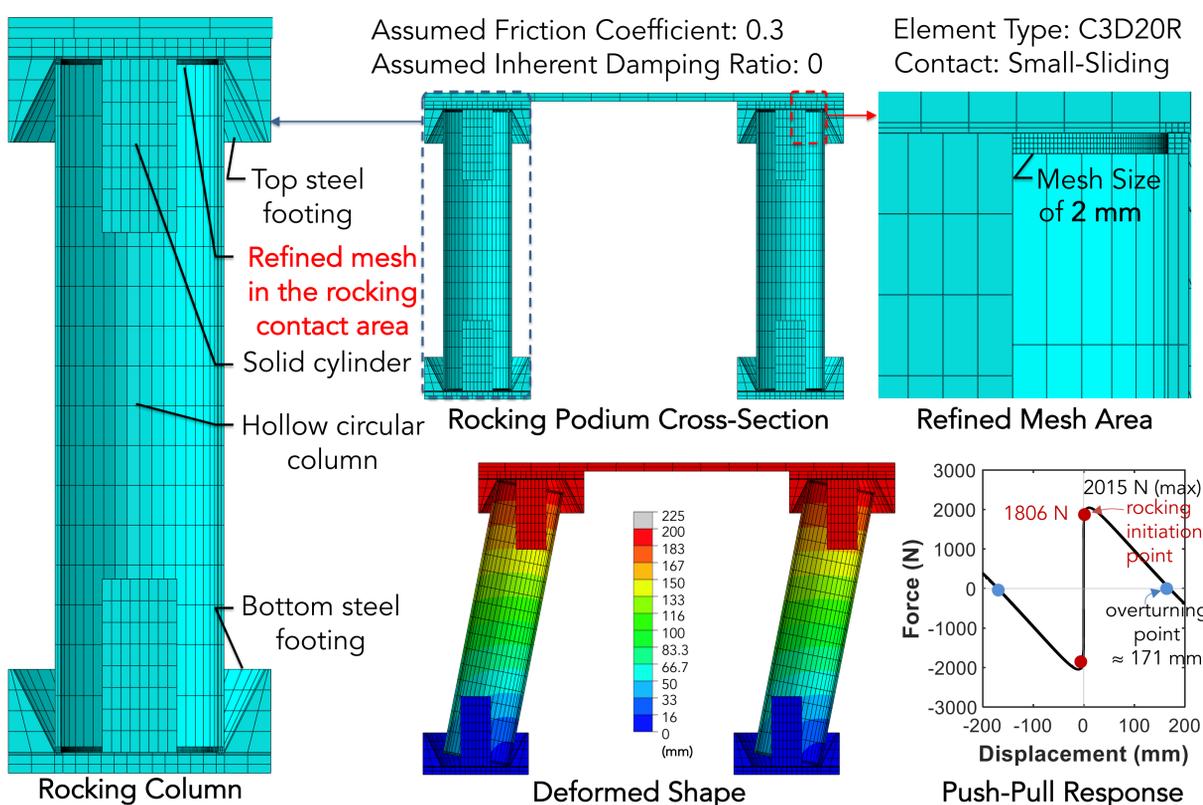


Figure 3. Finite Element Analysis of the Rocking Podium Structure

Results

Analysis results of 200 GMs are shown below:

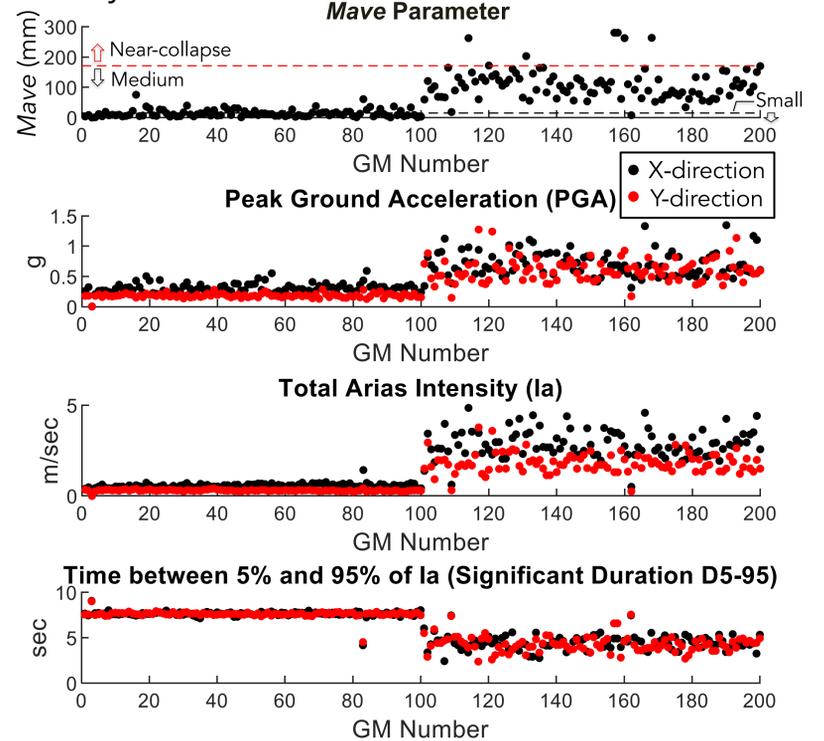


Figure 4. Ground Motion Characteristics and FE Results

Sample Rocking Responses are shown below:

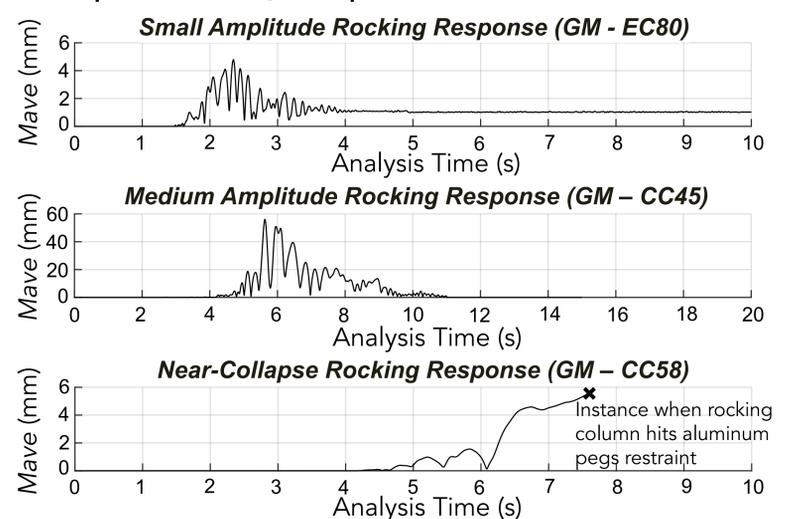


Figure 5. Sample Mave Parameter Histories

Conclusion

This study presents FE analyses of a rocking podium structure. It was found that the element type, mesh size and maximum time step had minor influences on the simulated behaviors, while the choice of contact algorithm greatly influenced the analysis stability. In addition, the assumed values of friction coefficient, and the relative stiffness differences between the rocking interfaces would influence the dynamic responses of the structure after rocking initiated. Further, the assumed value of inherent damping is expected to influence the structural responses and will be evaluated in future studies.