

## SEISMIC FRAGILITY ESTIMATION UNDER ORTHOGONAL EARTHQUAKE EXCITATIONS

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### ABSTRACT

Estimation of fragility functions using dynamic structural analysis is an important step in a number of seismic assessment procedures. This paper discusses the multicomponent seismic fragility curves based on beta distribution by considering the Iran-specific characteristics to manage the earthquake risk in the region. The seismic design of low- and mid-rise RC-MRFs are carried out according to the Iranian Code of Practice for Seismic Resistant Design of Buildings (Standard No. 2800), and the analytical models are formed accordingly in ZEUS-NL platform. A new optimal intensity measure (IM) called ( $S_{a, avg}$ ) is used to obtain reliable fragility-based database for earthquake damage and loss estimation of RC buildings stock. It is observed that the presence of vertical component of the strong earthquake excitation significantly affects the response of RC-MRFs and including this component simultaneous to horizontal components in the analysis is highly recommended for reliable seismic assessment of RC structures.

### INTRODUCTION

Earthquake hazard identification and structural vulnerability evaluation are the main components of earthquake risk assessment. Earthquake hazard identification is out of the scope of this study, but structural vulnerability evaluation is the subject of civil engineering and city planning disciplines and aims to determine, classify, and assess the fragility of existing building stock and other structures (dams, bridges, power plants, etc.) and are being focused in the current study.

For disaster management purposes, a fragility based assessment that considers local structural properties is required. However, local conditions are usually ignored and vulnerability based assessment studies for structures in different countries are adapted to earthquake hazard estimation and disaster mitigation. Unfortunately, differences in structural characteristics cause significant deviations on damage and loss estimation by influencing the resulting fragility curves. The aim of this study is to provide fragility information to inquire effects of ground motion parameters and Iranian construction practice state on structural vulnerability in the presence of vertical component of earthquake. After the devastating earthquakes that occurred within the last decades, well-organized and comprehensive seismic design code (Standard No. 2800, (1988, 1999 and 2005)) are published. Making use of this comprehensive design codes,