

AN EFFICIENT THREE DIMENSIONAL ANALYSIS OF SHEAR WALL BUILDING STRUCTURES WITH OPENINGS

Dong-Guen Lee¹, Hyun-Su Kim², Seung-Jae Lee³ and Hye-Sook Kim⁴

Dept. of Architectural Engineering, Sungkyunkwan University,
300 Chun-Chun-Dong, Jang-An-Ku, Suwon, 440-746 Korea.

¹ e-mail: dglee@skku.ac.kr

² e-mail: digiarchi@hanmail.net

³ e-mail: qzxas@orgio.net

⁴ e-mail: hselja@hanmail.net

Abstract. *The box system that consists only of reinforced concrete walls and slabs are adopted on many high-rise apartment buildings recently constructed in the Asian region. The framed structure with shear wall cores that can effectively resist horizontal forces is frequently adopted for the structural system for high-rise building structures. In these structures, shear walls may have one or more openings for functional reasons. It is necessary to use a refined finite element model for an accurate analysis of the shear wall with openings. But it would take significant amount of computational time and memory if the entire building structure is subdivided into a finer mesh. An efficient analysis method that can be used regardless of the number, size and location of openings is proposed in this study. The analysis method uses super elements, substructures, matrix condensation technique and fictitious beam technique. Three-dimensional analysis of a box system structure having various types of opening was performed to verify the efficiency of the proposed method. It was confirmed that the proposed method provides the results with outstanding accuracy requiring significantly reduced computational time and memory based on the analysis of example structures.*

1. Introduction

Recently, many high-rise apartment buildings are constructed in the Asian region using the box system, which consists only of reinforced concrete walls and slabs. The shear walls in a box system structures may have openings to accommodate the windows, doors, corridors and duct spaces for functional reasons as shown in Fig. 1(a). Window and door type openings, which are used frequently in shear walls of box system structures are shown in Fig. 1(b) and (c). The number, location and size of these openings would affect the behavior of a structure as well as stresses in the