Preface

A structure consists of two components as primary components, also called main components, and secondary components or non-structural components (NSCSs). The main components are designed to resist different types of loads. The NSCSs are connected to the main components, but they do not transfer vertical or lateral loads. However, the seismic load is similar to the primary component's nature. Examples of non-structural components are cladding panels, furniture, transformers, partition walls, etc. Initially, it was assumed that the NSCSs do not affect the stiffness and the seismic effect of the building, but recent experimental studies found that during the seismic action, the NSCSs also influence the stiffness and the seismic response of the structures. Over the previous four decades in the world, the cost of non-structural elements (NSEs) has risen as a percentage of the project's total construction cost. With high expectations of functional performance of buildings and higher maintenance costs, the cost of NSEs soared from a paltry 5% in the 1970s to a dominating 70% in the 2000s. Because changes in building performance are projected to be minimal, NSEs costs are expected to saturate during the next decade. Furthermore, many NSEs (used in modern buildings) have not been tested to show that they can withstand substantial earthquake motion. Over the previous three decades, the average economic loss due to earthquake-related NSEs failure in the United States has been estimated to be roughly US$2-0-4.5 billion per year.

NSE can be divided based on acceleration sensitive subsystem and storey drift sensitive subsystem. Several studies have been done proposing some guidelines to investigate the behaviour of storey drift and acceleration-sensitive non-structural components. Based on the minimum equivalent force method for a new building and the improvement of the existing building, some code provisions are discussed in the literature for the designing of non-structural components. These provisions were partially based on the analytical studies and partly based on the data recorded by instrumental building.

The inertia force acting on the NSEs is determined with the help of the acceleration amplification factor. A limited study has been done to determine the acceleration amplification factor. Some of the codes observed that the amplification factor only depends on the height of the buildings. However, some researchers observed that it depends on the building's natural time periods. UBC code marks that the amplification factor is only dependent on the normalised height of the building and its maximum value is 4. However, ASCE code provides the maximum value of the amplification factor as 3, and the IITK model remarks the maximum acceleration amplification value for RC structure is two and is dependent on the normalising height of the building. Some researchers presented the acceleration amplification factor formula based on structures' height and fundamental period. However, it was observed that the amplification factor depends not only on the fundamental period of the structures but also on the range of the ground motion.

Since the amplification factor also depends on other factors such as ductility ratio, building support conditions, types of structures, etc., this research work aimed to determine the amplification value of the structures using FEM based software. For this, five different heights of the building models have been considered. These models were analysed using linear and nonlinear time history methods with a varied range of ground motion considering the rock-type soil. For obtaining the amplification values, two different support conditions were considered. In the first case, the base of the structures was fixed to obtain the amplification values. These amplification values were compared with the previously proposed models. It was observed that the previous amplification models produced conservative results as the natural period of the structures increased. The researchers consider the fundamental natural period but account for the maximum structural period as 2.5 sec, which is not always true. The values of structural period are not constant for all types of ground motion. It varies between 2.5 to 5.5 sec. with the range of the ground motion. The amplification models for low to moderate hazards were proposed, which performed better than the other models. Furthermore, it was also observed that as the height of the building increases, the nature of the amplification factor is nonlinear. So non-linear mathematical amplification models are proposed to determine the amplification factors.

For incremental dynamic analysis, the amplification factor is affected by the height of the building, the natural period of the building, and the ductility ratio. Based on these factors, the amplification formula has been proposed, which gave satisfactory results compared to the previous models. The second case considered as the base of the structures is pinned supported with a low to moderate range of the ground motion and obtained the amplification values. These amplification values are compared with the previous proposed models and also compared with the amplification values with fixed support conditions. It was found that no single model performed satisfactory results so that to developed the new mathematical amplification models, based on some factors (ductility ratio, effective time periods etc.), which gave better results compared to the previous models.