In the modern engineering field, experimental dynamics is an important area of study. This area includes structural dynamics, structural control, and structural health monitoring. In the experimental dynamics, obtaining measuring data has experienced a great influx of research efforts to develop an accurate and reliable experimental analysis result. A technical challenge is the procurement of an informative data that exhibits the desired system information. In many cases, the number of sensors is limited by cost and difficulty of data archive. Furthermore, some informative data have technical difficulty to measure and, even if obtaining desired data, it could include much noise in them. As a result, researchers have developed many analytical tools with limited informative data. Subspace identification method is one of achievements in these tools.

Subspace identification method includes three different approaches: Deterministic Subspace Identification (DSI), Stochastic Subspace Identification (SSI), and Deterministic-Stochastic Subspace Identification (DSSI). The subspace identification method is widely used for fast calculating speed and its accuracy. Based on the various data condition, DSI, SSI, and DSSI are differently applied under specific assumptions, which could affect their analytical results.

The objective of this study is to observe the effect of assumptions on subspace identification with various data conditions. Firstly, analytical simulation study was performed using a six-degree-of-freedom mass, damper, and spring system is created by MATLAB. Various conditions of excitation insert to the simulation test model, and its excitation and response are analyzed using the subspace identification method. For stochastic problem, artificial noise contained to the excitation and followed the same steps. Through this simulation test, the effects of assumption on subspace identification are quantified.

Once the effects of the assumptions were studied using the simulation model, the subspace identification method was applied to dynamic response data collected from large-scale 12-story buildings with different foundation types that were tested at Tongji University, Shanghai, China. Three different excitation types at fixed foundation were used for verifying the result of the simulation test. Noise effect, frequency band range effect, time duration effect, and stationary state effect had been analyzed. From the experiment data analysis, the effects of assumption on subspace identification are verified.