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# Conceptual design of dynamic vibration absorber for mitigation of subway tracks vibration

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## Abstract

The vibrations and sounds of the train movement that cause damage to buildings close to the train lines are one of the critical challenges for constructing urban rail lines. The system's vibration causes acoustic noise, and it is necessary to use vibration absorbers or viscose dampers to control it. In this study, a dynamic absorber is presented, which absorbs the vibrations without transferring them to the support and depreciation of sound energy. For this purpose, modal analysis of rail track has been done, and vibrational behavior of subway track has been investigated. The vibration model of the rail track has been decoupled into four degrees of freedom system. The similarity of mode shapes obtained from the experimental test and gained from modal analysis indicates the accuracy of the presented vibration model. According to the theories expressed and optimization in MATLAB, the optimal parameters for vibration absorber has been investigated. It is shown that utilizing an absorber can mitigate rail sound and vibration.

**Keywords**: Modal analysis; Vibration mitigation; Dynamic vibration absorber; subway track.

## 1. Introduction

One of the essential criteria for the safety and quality of rail transport is the quality of railway lines. Line vibrations are critical in studying the quality factors of railway lines. One of the efficient methods of modeling rails and railway structures is using modal analysis to eliminate or reduce these vibrations of railway lines. Modal testing involves measuring FRFs or structural impact response. FRF measurement can be done by applying a force (measured) at one point in the structure without other excitation forces and measuring the vibration response at one or more points in the system [1, 2, 3]. Vibrational modeling of rails has been done in different ways and has been studied