Chapter 9
Design and Parametric Analysis of Excavator Arm Using Finite Element Analysis

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ABSTRACT

Excavators are earth moving equipment used in excavating hard rocks and soil underneath the natural surface of the ground. Due to unpredictable conditions the excavator parts like boom, arm, bucket, and bucket teeth are subjected to high loads. During the excavation operation, there is an obscure resistance forces offered by the terrain to bucket teeth, which in turn are passed on to arm of the excavator. These forces have an adverse effect on the excavator. Thus, the excavator parts are made with high strength, which makes the parts heavy. This in turn increases the initial fabrication cost and operating cost due to heavier operating parts. Therefore, this work deals with optimizing the design and conducting FEA to existing excavator arm. In this work, finite element analysis (FEA) of existing excavator arm is compared with optimized arm for stresses and deflection. This chapter discusses finite element-based optimization of excavator arm, and the most appropriate design is identified. Further model analysis is performed to check stability in the model and compared with the existing model.

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1. INTRODUCTION

A hydraulic shovel of a bucket type excavator is an earthmoving machine. It consists of major parts such as a rotatable chassis mounted on upper side of a drivable body with wheel or track, hydraulically powered mechanism consisting of bucket, arm and boom, located at the upper chassis. Applications for excavator as a utility machine at large construction sites and urban infrastructure projects as well as the loading of hoppers and trucks, trenching, the cleaning of canals and trenches, general infrastructure excavation, solid waste management and even demolition and mining work. The useful task of backhoe hydraulic excavator is to free and/or remove surface materials such as soil from its original location and transfer it to another location by lowering the bucket, for digging the soil, pushing and/or pulling of soil then lifting, swinging.

The excavation of this task is usually performed by a human operator who controls the motion of the machine manually by using the visual feedback provided through his or her own eyes. Normally excavators are work under severe working condition

Figure 1. General view of excavator

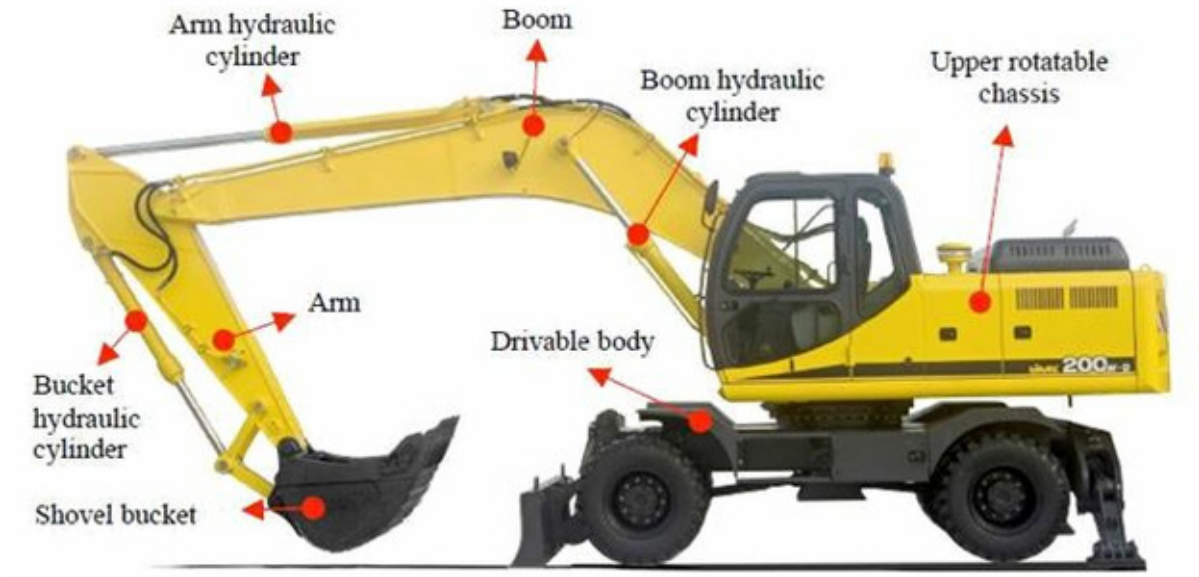

Fig 1.1 General view of excavator