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Dynamic analysis of substructures when tested in isolation using finite element method

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Abstract

This work reports on the application of the proposed technique of substructural analysis to the experimental work. The purpose of this investigation is to establish a procedure to perform experimental impact analysis on a substructure in isolation. It is well known that the response of a substructure subjected to impact loading in isolation is different than the response of the same substructure within the system. This primarily is caused by the boundary conditions imposed on the substructure from the surrounding subsystem in the entire structures. The implementation of these boundary conditions in physical world is extremely difficult if not impossible. Therefore, to perform experimental testing on substructure in isolation requires the determination and implementation of these boundary conditions. In the first part of this manuscript, the FE formulation was explained. In this manuscript the experimental the application of a numerical technique previously proposed by the authors is studied. To do this, a crash testing facility was developed so that impact testing on a structure can be performed. The full structure was impacted first and then the substructure was tested based on the appropriate mass and velocity as determined using the proposed technique.

Key words: *Structural impact, FFT analysis, Subcomponent testing, Experimental setup*

1. Introduction

In spite of tremendous progress achieved in crashworthiness simulations of vehicle structures from components to full-scale vehicles using the latest techniques in computational mechanics, final assessments still rely on laboratory tests. There are three main categories of tests: component tests, sled tests and full-scale barrier impacts. The complexity of these tests increases from full-scale to subcomponent testing. This may cause a decline in test repeatability, a reality that may not become apparent from the mathematical model. The component test determines the dynamic response to loading of an isolated subsystem from the full-scale testing. These component tests are crucial in identifying the crush mode and energy absorption of structure. Understanding their performance is essential to the development of prototype substructures

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