

Adams/Car Tutorial

Modifying Suspension Hardpoints

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Overview

In ADAMS/Car hardpoints are the building blocks for larger components. The hardpoints are essentially the joint locations for the parts of the vehicle. In ADAMS/Car you will move suspension hardpoints to change suspension kinematics, steering hardpoints to change steering characteristics, etc. For example, you can move the outer steering tierod connection to the upright to adjust Ackermann steering. When you move a hardpoint, ADAMS/Car moves the joint location to the position you specify. The actual connections at the hardpoints are modeled as ideal joints with specified degrees of freedom or bushings with 6 degrees of freedom and joint stiffnesses.

The FSAE and Mini-Baja frames have no role in defining hardpoint locations. Hardpoints mounted to the frame are all connected to a rigid chassis. The image of the frame has no structural role in ADAMS/Car.

Common abbreviations found while modifying the suspension are found below.

hp[lr]	hardpoint left or right
arb	anti roll bar
lca	lower control arm
prod	push rod
uca	upper control arm

Control Arm Hardpoints

The suspension control arm geometry defines suspension properties such as roll center, motion ratio and camber profile. With ADAMS/Car you can adjust the control arm geometry by adjusting hardpoints and then simulate wheel travel to determine the kinematics for the new geometry. The FSAE model has independent suspensions front and rear. The Mini-Baja model has independent front suspension and an independent or rear swing arm suspension. To modify the control arm of an open suspension subsystem click *Adjust>Hardpoint>Table* and the Hardpoint Modification Table will appear.

Adams Car Tutorial Modifying Suspension Hardpoints

RJ Alexander



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Vehicle Suspension Geometry Sensitivity Analysis Using ADAMS/Car and ADAMS/Insight Karthik Krishnan, Colorado State University. Department of Mechanical Engineering, 2007 *Methods for Choosing Front Suspension Geometry Based on ADAMS/Car Simulations*, 2002 **FSAE Racecar Suspension System Design Process Using ADAMS/CAR**

Christopher Harris, 2006 This document's intended purpose is a guide instructing how to successfully design a suspension system for a prototype racecar while also conveying clearly and concisely the different variables that affect the suspension system's performance. Charger Motorsports Formula Society of Automotive Engineers FSAE team members will primarily use this guide for upcoming suspension designs but it may also be used freely by others who may find it useful. The design concept will be of a style suitable for a small open wheel racecar and should by no means be applied in any other framework although some aspects of the design process can be translated to other vehicles. The primary contribution of the author is relating the theory of suspension system design to the analysis of the suspension system design in ADAMS CAR.

Simulation of a Vehicle Suspension with the ADAMS Computer Program N. Orlandea, M. A. Chace, 1977

Validation of an Adams Vehicle Suspension Model Via Modal Testing Matthew Aaron Johnson, 2003 In racing any means of generating reliable suspension data in a timely fashion is desirable. In an effort to tune race vehicles many teams have adopted vehicle simulations as a low cost means of testing. The question that always arises with model simulation is the validity of said model. This research shows the investigation of modal testing of an established vehicle suspension. It is theorized that determining the vehicle's resonant frequency would be sufficient in describing a model that would respond to the varied inputs as seen between the tire and track interface. In a fashion similar to hammer tests in modal testing the vehicle was tested using generalized impulses. The resulting chassis acceleration data was then processed using power spectral density routines in MATLAB in order to determine the resonant frequency of the suspension system. From there the ADAMS model was excited in a manner similar to the physical vehicle to generate chassis accelerations. The model underwent several iterative changes including mass geometry and tire property adjustments. Although some of the iterations fell within a 0.75 Hz range of the model target the model that most closely represented the current understanding of the physical system had an error of 1.5 Hz with a 0.25 Hz resolution. Therefore additional research into the mass properties measurement of the suspension components and additional tire information is necessary to understand the differences.

Suspension and steering systems analysis and design optimization of a CM class hill climb race car using ADAMS/Car Alberto Pello, 2008 Car Suspension and Handling Geoffrey Howard, John Peter Whitehead, Donald Bastow, 2004-02-07 Through appendices and diagrams *Car Suspension and Handling* 4th Edition outlines the purpose and history of vehicle suspension systems while defining the basic parameters of suspension geometry. In addition the book delves into human sensitivity to vibration and offers data on durability tire background information steering calculations and suspension

calculations

RMIT FSAE Race Car Suspension Modelling and Optimisation in MSC.ADAMS/View ,2006

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