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Modal Analysis of a Heavy Tactical Wheeled Vehicle

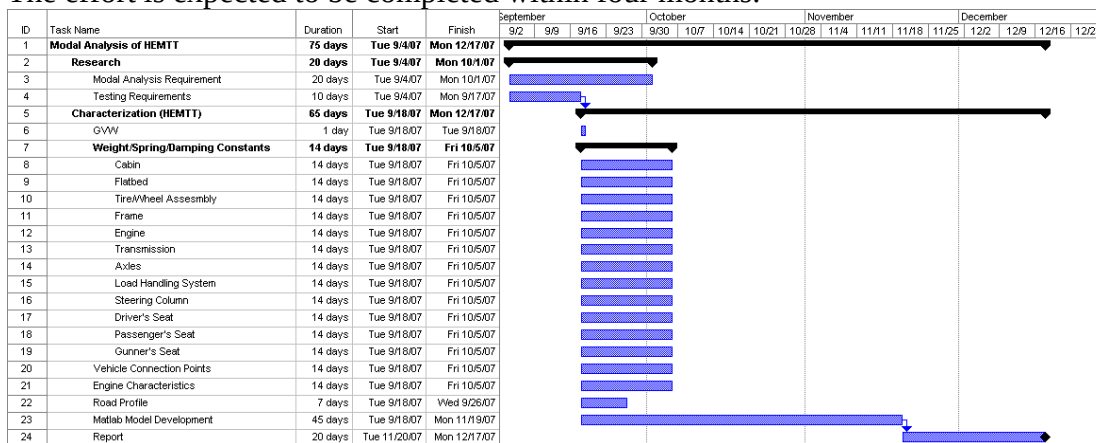
AUTO 503 Final Project-Masters of Engineering-Automotive Engineering Program-2007

The project's objectives are to model and simulate a heavy tactical wheeled vehicle with gross vehicle weight rating of 66,000 lbs, the Heavy Expanded Mobility Tactical Truck (HEMTT) M1120A4. Matlab will be used to complete a modal analysis of the half-truck model identifying the first 10 natural frequencies with corresponding mode shapes, the response of the cabin with input from the road, and the firing frequency of the selected engine. The analysis will consist of a baseline vehicle weight with a peacetime configuration and conclude with a parametric analysis of increasing the cabin weight, simulating the increased protection of the vehicle. The project goals will be to develop a detailed mathematical model of a heavy tactical wheeled vehicle. The detailed model will be used to complete a modal analysis identifying the fundamental vibration mode shapes and corresponding excitation frequencies which will be used to identify steering column and seat vibration impacts to the Soldier and crew.

The focus of this effort is to characterize and understand the impact of b-kit armor additions to the natural frequencies and mode shapes of a heavy tactical wheeled vehicle. The Army has identified a modular approach to protection identified as the Long Term Armor Strategy (LTAS) A-kit/B-kit approach. The LTAS A-Kit includes the automotive components of the vehicle and a baseline cab that incorporates the structural components for B-kit or increased protection components. The B-Kit would then consist of additional survivability technologies that can be applied to an A-Kit equipped vehicle in the field.

The mathematical model of the dynamic system will be used to approximate a particular frequency response function (FRF) to simulate the vibration characteristics of the cabin structure given the various inputs. The development of the mathematical model will approximate the system with lumped masses comprising the frame, wheel/tire assembly, powertrain, cabin, and flatbed. A sensitivity analysis of parameter variation will be performed to identify the critical parameters and limitations.

The effort is expected to be completed within four months.



The project would be completed at TACOM located in Warren, Michigan under the supervision of Calvin Kolp and Heather Molitoris as the principle. The faculty supervisor would be requested as Dr. Nickolas Vlahopoulos, nickvl@umich.edu.