OverTilt Motion Drive Algorithm

Realtime Technologies' (RTI) Motion Drive Algorithm (MDA) is designed to generate an optimal set of motion cues while keeping the motion system within its physical limits. We use a tuning file to select the parameters for the MDA.

OverTilt®

OverTilt® provides an advanced form of tilt coordination. It fully coordinates the linear and angular movement of the motion base, providing optimum specific force cues, and high frequency *and* sustained specific force cues.

Using OverTilt , we've achieved "adaptive" type algorithm performance without running into complex tuning requirements or the instabilities you usually encounter when using such algorithms.

The OverTilt algorithm can be quickly configured for a variety of motion bases, both large and small. For linear specific force, only three parameters must be configured:

- maximum specific force
- maximum position
- maximum tilt rate

OverTilt performs motion base pre-positioning as determined by the current input acceleration. It also provides smooth adjustments in the commanded specific force, avoiding large false cues which can occur when the motion base reaches its excursion limits.

OverTilt has been used in conjunction with motion bases from:

- MTS
- Burke Porter
- McFadden
- Moog
- Motionbase PLC
- Tsunami Visual Technologies

Benefits

- Requires only three parameters to tune for each linear channel including tilt coordination.
- Maintains maximum position parameter keeping you from hitting limits.
- Limits Tilt Rate and Tilt Acceleration, eliminating false rotational cues.
- Prepositions based on the current input acceleration effectively doubling the motion envelope, fully integrated with the maximum position parameter.
- Tracks the position, velocity, tilt, and acceleration of the motion base, selecting the optimum tilt angle and cue to be represented.
- Reduces filter reference frame effects that are common in the Classical Algorithm.
- Allows you to rapidly manipulate the algorithm because it is based on SimCreator technology.

Classical Mode

A Classical Mode, which RTI's MDA also includes, filters the three channels of angular velocity and three channels of specific force using a set of six 2 pole, 2 zero filters. In addition, a set of two low pass filters, with tunable break frequencies, are used to control tilt coordination. All filter parameters are adjustable in the tuning file.

Shared Tuning Parameter Characteristics

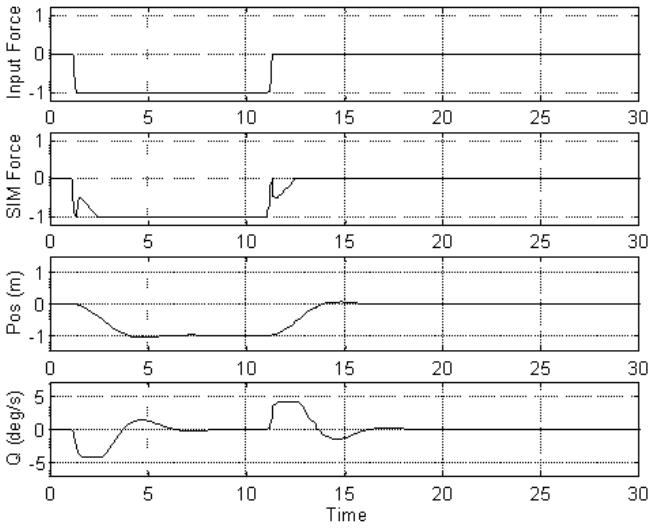
In both the Classical and OverTilt Modes, tuning parameters control several additional features:

- Offset of the tilt coordination axis to move from motion centroid to operator's head.
- Independent gravity scaling and limiting, which provides greater stability when used in aircraft or entertainment simulation.
- Direct correlation of vehicle orientation to motion base orientation, which provides increased performance when used in ground vehicle simulation.

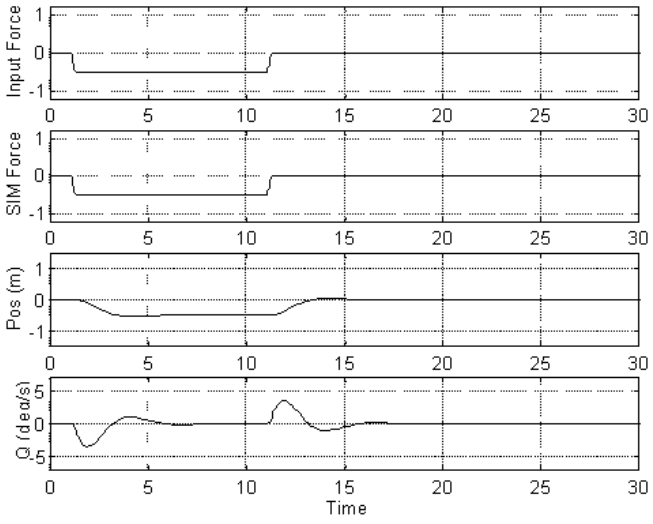
Performance Examples

Tuning for Motion Base With 1.0 Meter of Linear Travel:

Max Accel: 1.00 m/s/s
Max Steady State Position: 1.0 m
Max Tilt Rate: 4.2 deg/sec



This example is the same size motion base with the same tuning parameters as above responding to a 0.5 m/s/s acceleration. (The non-linearity of the algorithm in this case eliminating the sagging and false cues).



Why use an MDA?

The purpose of a Motion Drive Algorithm (MDA) is to cause a simulation motion base to move in a manner that feels realistic to the person experiencing the simulation.

The motion base, with its simulated vehicle cab, sits in one place and is constrained in it's envelope of movement. Yet it must replicate the experience of traveling several miles on-road, off-road, in air and under water — whatever conditions the simulation requires.

Therefore, the software that controls the motion base requires an algorithm that calculates motion position commands, ensuring that the simulated experience feels realistic while keeping the motion base within it's given constraints.

Typically, the input to MDAs are elements of motion that are sensed by people — vehicle acceleration and vehicle angular velocities.

Tilt coordination is a method of using gravity to represent sustained vehicle acceleration by tilting the cab. Tilt coordination must be done slowly so that the person in the simulator doesn't sense rolling or pitching.

Realtime Technologies' MDA calculates in realtime (while the simulation is occurring), the appropriate cues to send to the motion base including tilt coordination. This makes our MDA distinctive and especially effective.

Please review this data sheet for more in-depth, technical information.

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Realtime technologies, inc
simulation vehicle dynamics human factors

Realtime Technologies, Inc. (RTI), specializes in real time multibody vehicle dynamics, and graphical simulation and modeling. We offer simulation software applications, consulting services, custom engineering, software, and hardware development. Realtime Technologies' customer base includes international, government and private entities. RTI was founded in 1998. For more information, visit us at www.simcreator.com.

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