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Matlab and Simulink Creation and Animation of X3D in Web-Based Simulation

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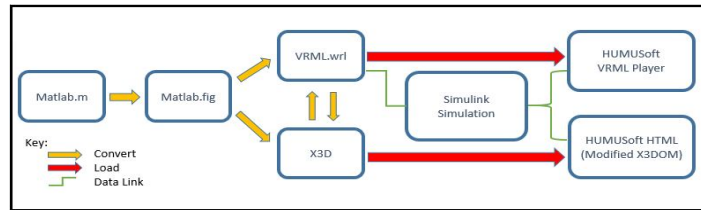


Figure 1: Design Patterns for Matlab/Simulink Creation and Animation of X3D in Web-Based Simulation.

Abstract

Matlab is a powerful tool to compute high-fidelity engineering model and plot the result in figures. Simulink implements Matlab .m source code into block diagrams and flow charts to execute the simulation. This project demonstrates how physics equations implemented in Simulink can animate X3D or VRML models, along with the methods to convert Matlab .fig format into an X3D object so we can apply it into Web-based animations.

CR Categories: I.3.6 [Computing Methodologies]: Computer Graphics—Methodology and Techniques

Keywords: X3D, VRML, Matlab, Simulink, real-time physics.

1 High-Fidelity Engineering Model Application

Matlab is capable to implement complex physics equations or models and graph the result. In this demonstration, we calculated a phased-array antenna radiation pattern from Matlab and plotted it as .fig. Then through the conversion process (Figure 1), the plot was transferred into Web-based 3D models, such as .wrl, .x3d scenes (Figure 2). Therefore we can both produce and animate high-fidelity 3D models generated from theoretical equations.

2 Matlab/Simulink Animation of X3D Models

For the bouncing box model (Figure 3), Simulink block diagrams compute the movement of the red cube by free-fall dynamic equations, and implement Hooke's Law to compute the resilient force of cube during its collision of ground. In turn, the resilient force is proportional to the compression ratio of the cube. The cube model is animated by position and "squishiness" scaling parameters which are computed through Simulink (Figure 4). Using the X3DOM viewer modified by HUMUSoft, the animation can also be executed on Web browsers without extra plug-ins. By rendering proper coefficients of similar high-fidelity models with physics equations, there can be rigorous scene animations presenting physics objects and equations. This capability has a wide variety of applications for engineering, education, and scientific visualization. Upcoming work will examine the feasibility of highly detailed propagation, collision detection, and real-time visualization of radio frequency beams.



Figure 2: Phased-Array Antenna Beam Pattern Created in Matlab .m Source and Converted to .x3d and .wrl Models.

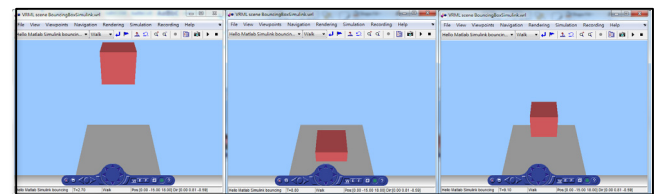


Figure 3: Free Fall, Compressed, and Post-Bounce Cube.

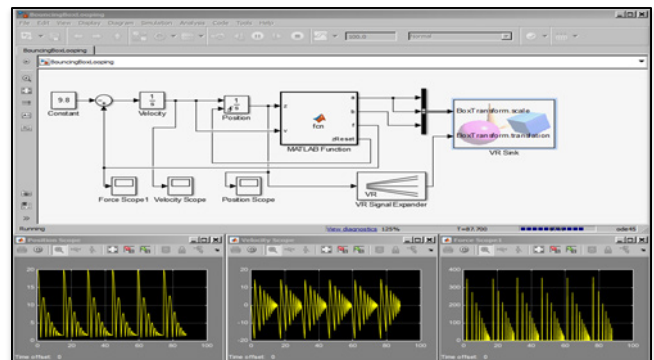


Figure 4: Block Diagrams of Simulink Implementation with Plotted Position, Velocity, and Force Variation of Cube.

References

HUMUSOFT, MATHWORKS, Simulink 3D Animation Examples.
<http://www.mathworks.com/help/sl3d/examples/bouncing-ball.html>

DON BRUTZMAN, X3D for Advanced Modeling Examples Archive.
<http://x3dgraphics.com/examples/X3dForAdvancedModeling/Matlab>

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