ATTACHMENT 1

Safety Board Kinematics Code Validation Summary

Before using the Safety Board's kinematics programs to validate the Boeing kinematics method, the programs were themselves validated. This is outlined on the following pages.

Simulation program Validation

Boeing provided checkout data, a set of driver control time histories and simulator results, for the 737-300 when operated in the speed regime and flaps 1 setting of the accident. The 737-300 simulation matched this checkout data (except for high rate stalls, low rate stalls were OK). The lack of fidelity in high rate stalls does not impact the validation of the rudder movement which occurred pre-stall.

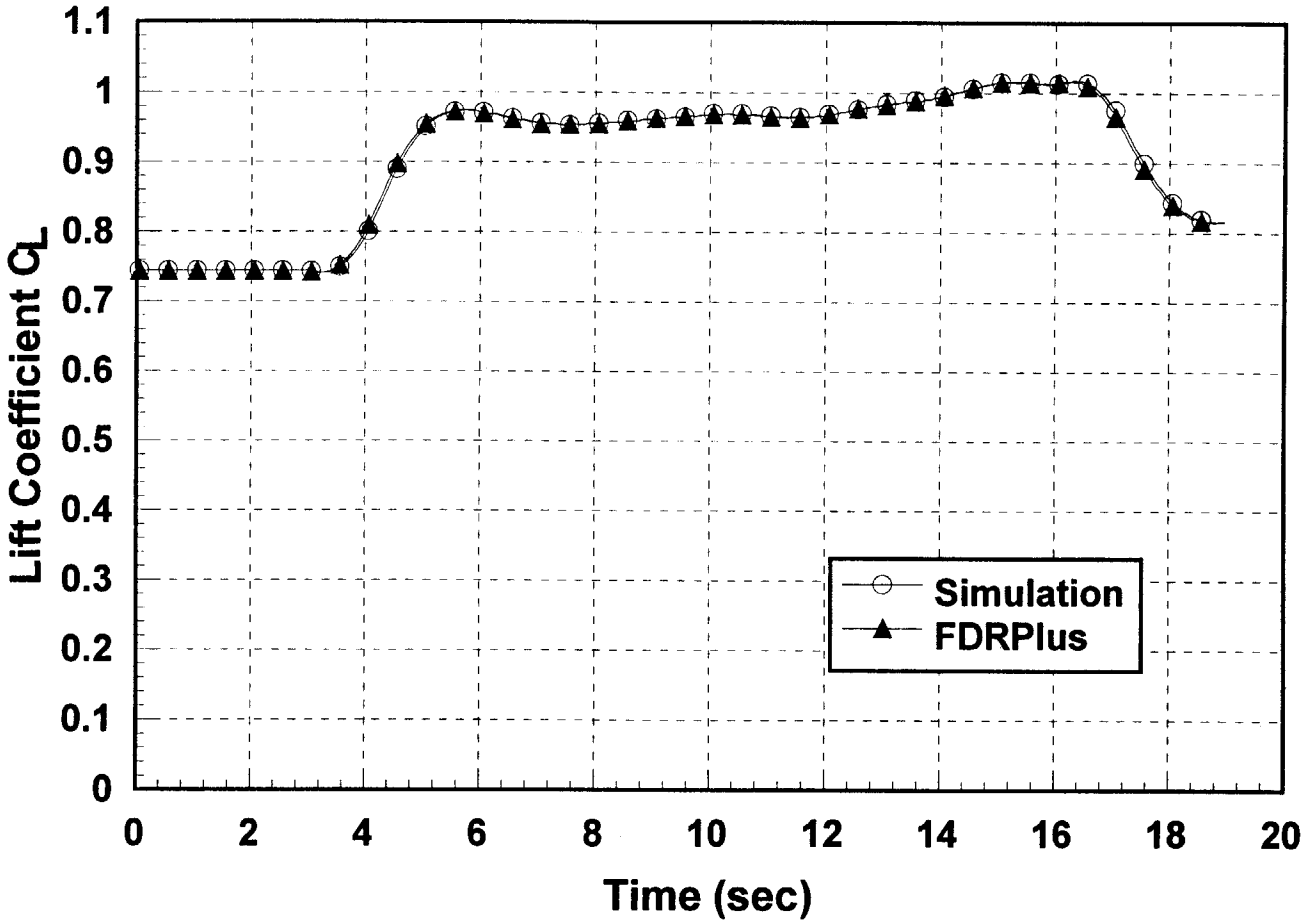
Columnar program Validation

The Columnar code was validated by comparing the program output with results calculated on paper for linear interpolation.

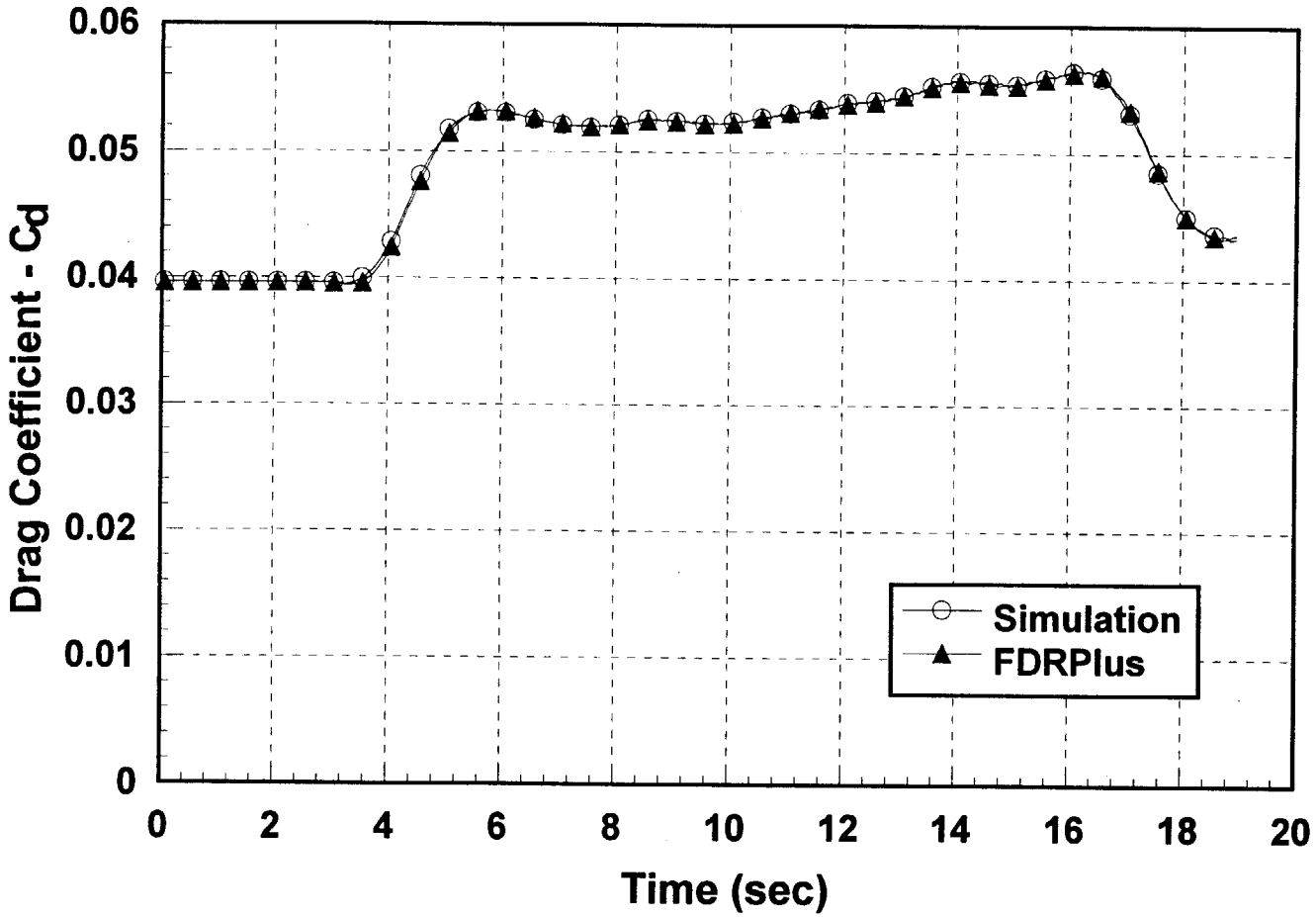
FDRPlus program Validation

The FDRPlus code was validated by using the 737-300 simulation to generate FDR parameters. These parameters were input into FDRPlus and the resulting aerodynamic coefficients and other output compared to the parameters generated by the simulation. The results are presented on the following pages.

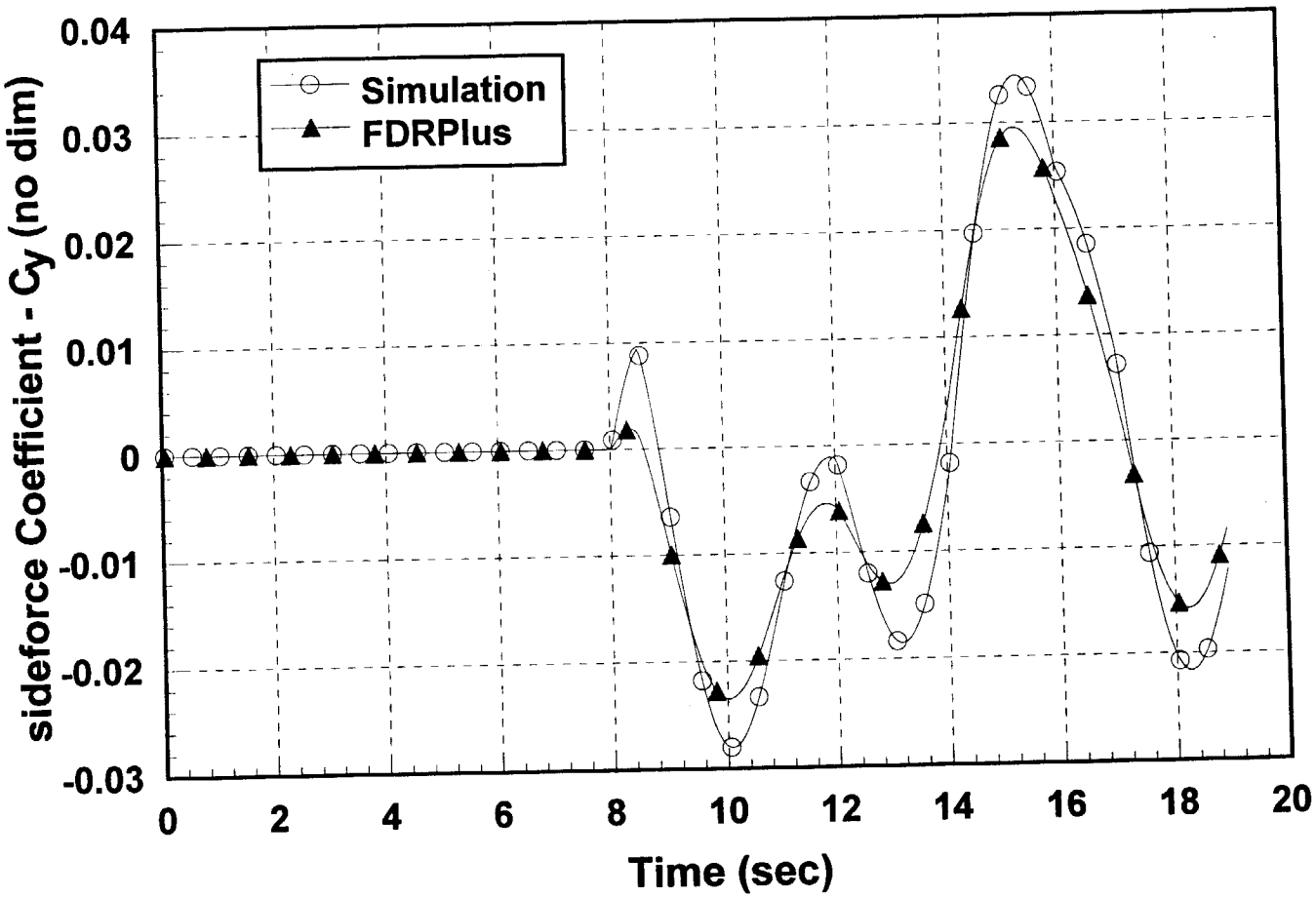
FDRPlus Validation
Beta from trace option



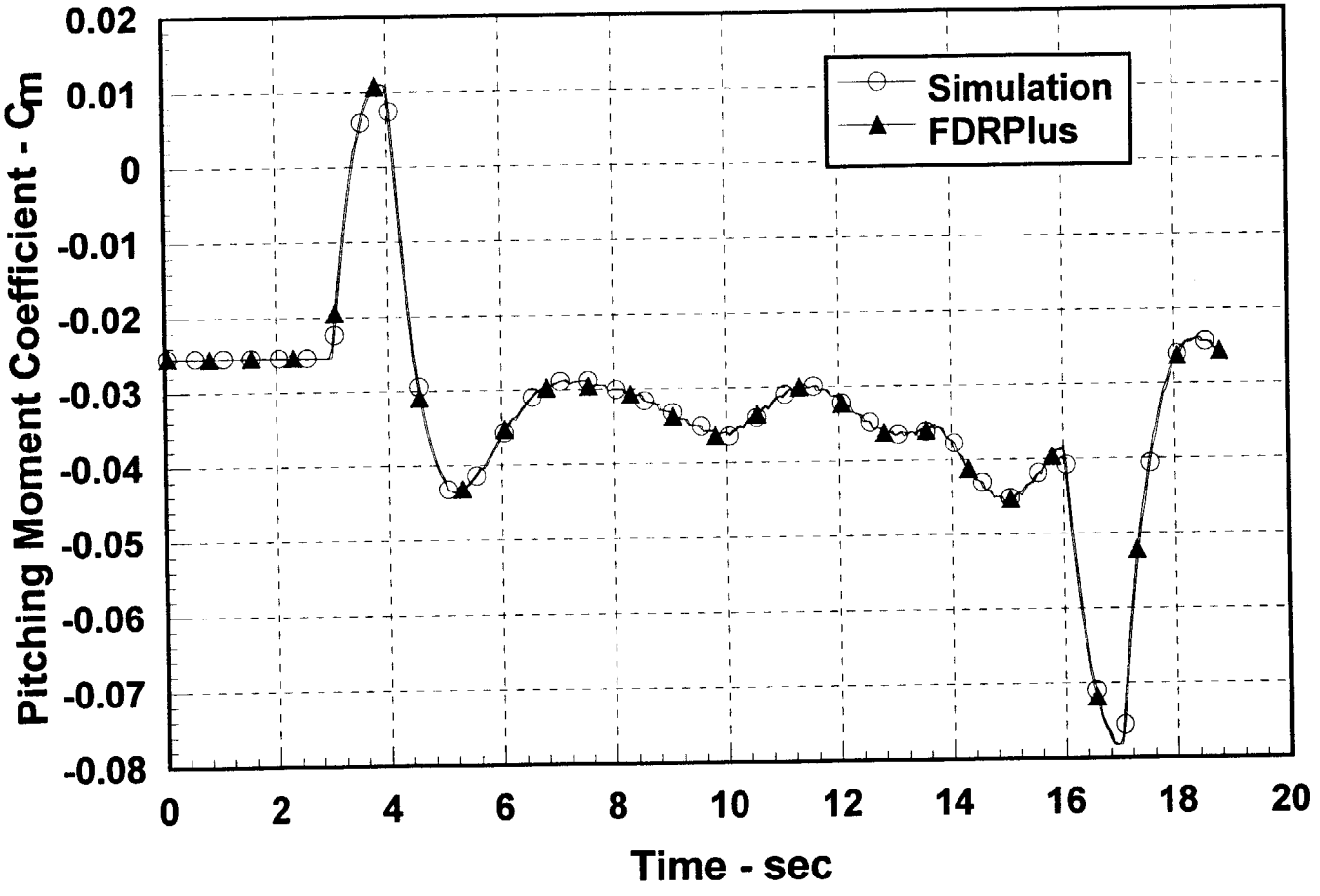
FDRPlus Validation
Beta from trace option



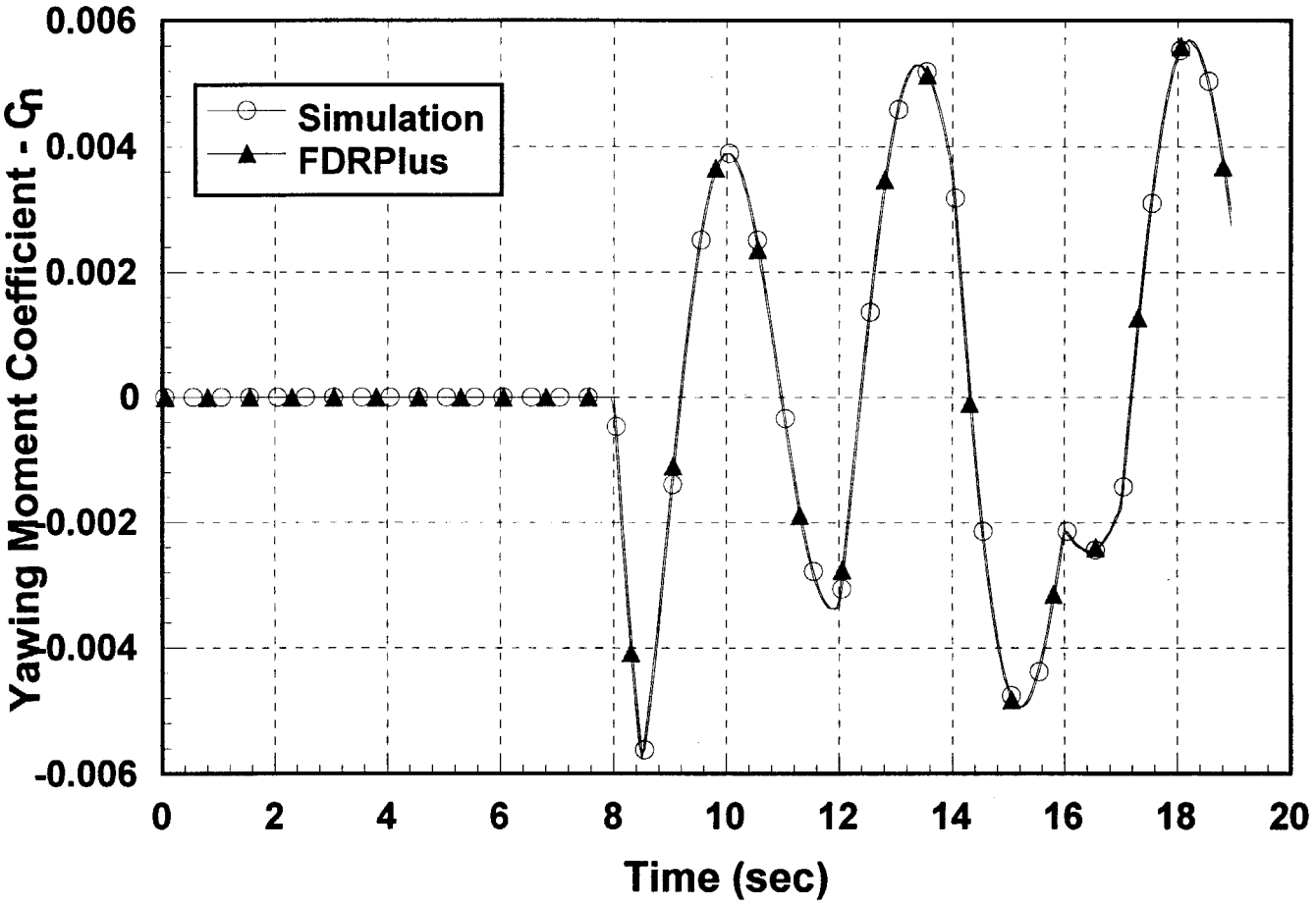
FDRPlus Validation
Beta from trace option



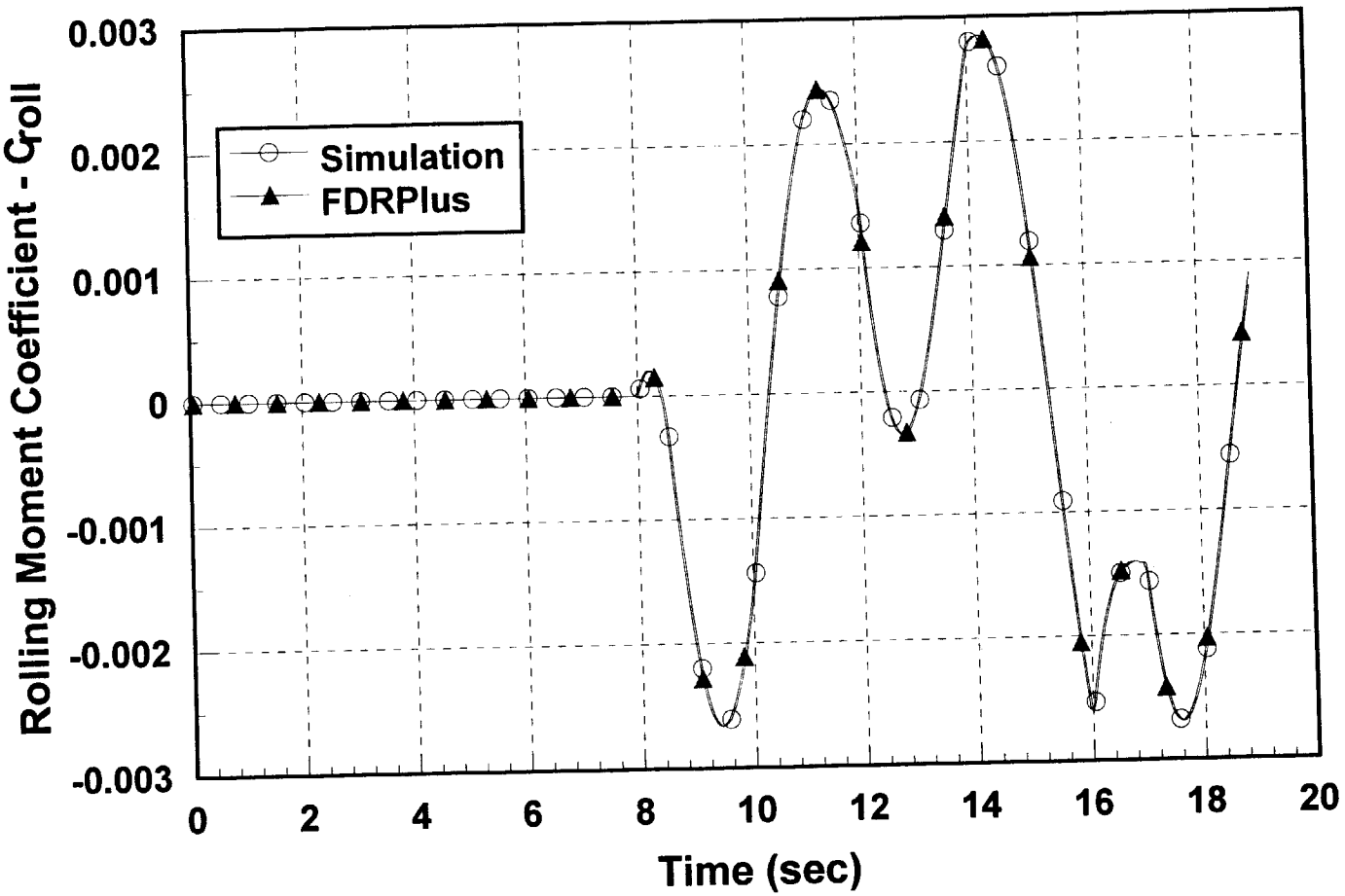
FDRPlus Validation
Beta from trace option



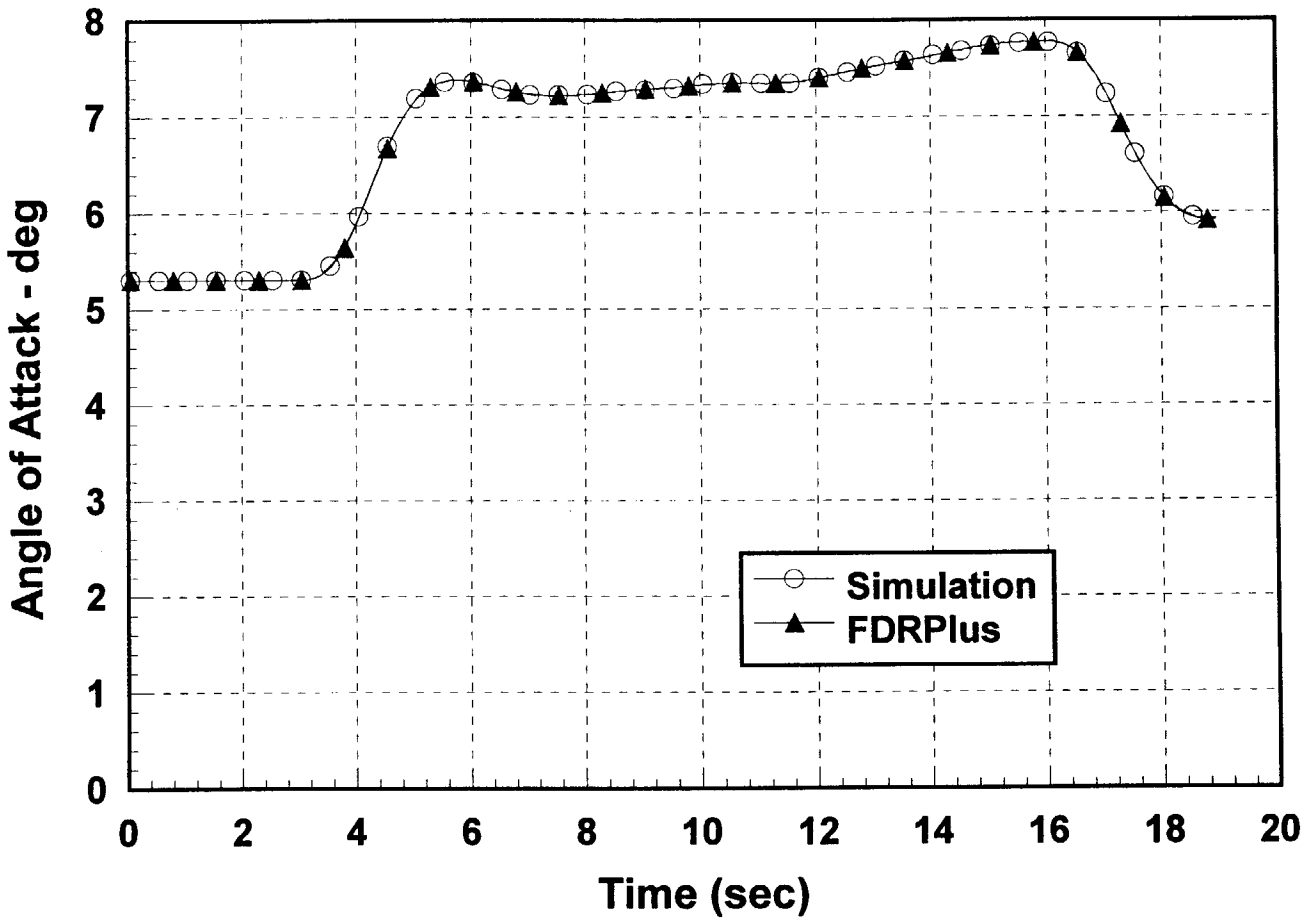
FDRPlus Validation
Beta from trace option



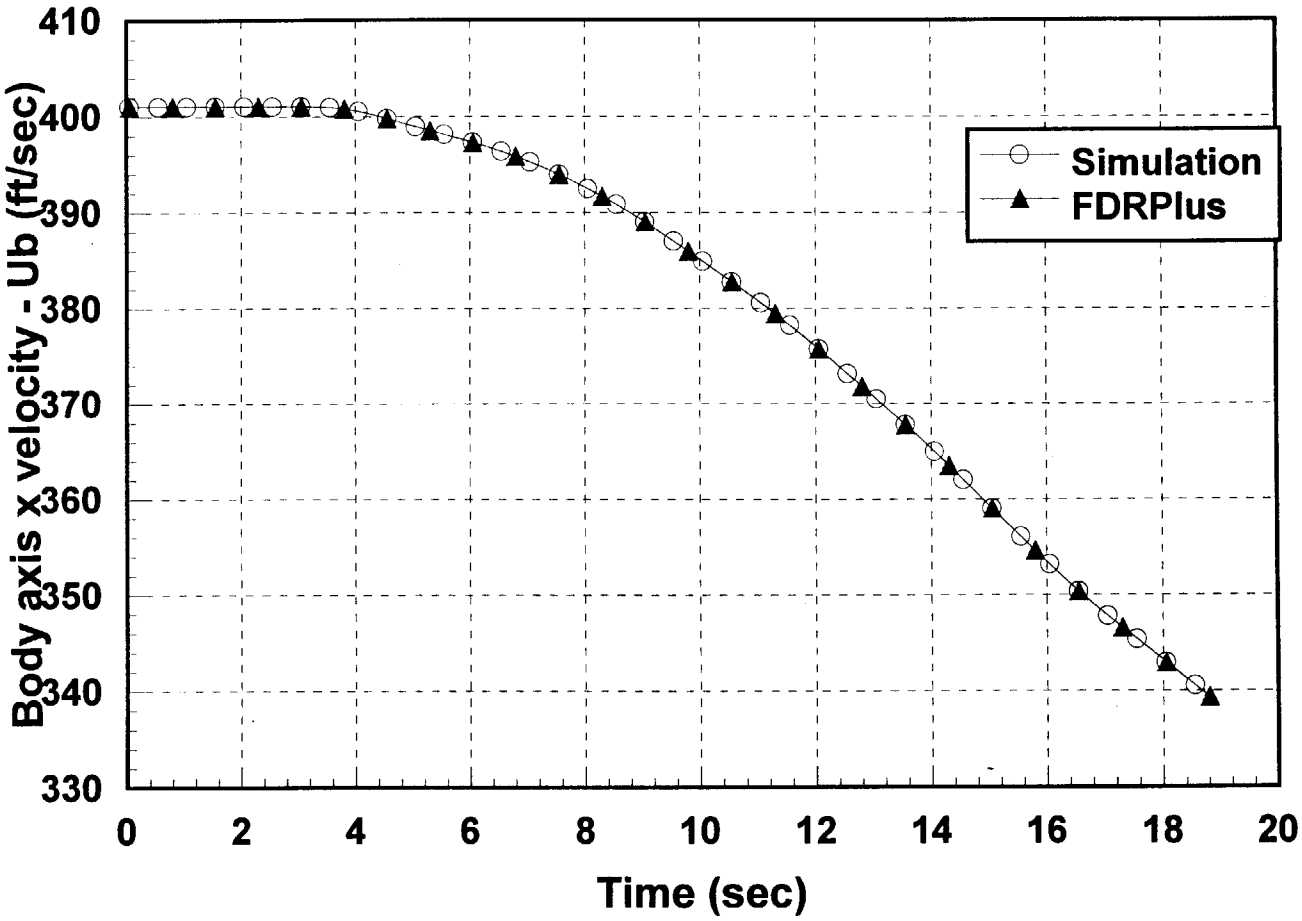
FDRPlus Validation
Beta from trace option



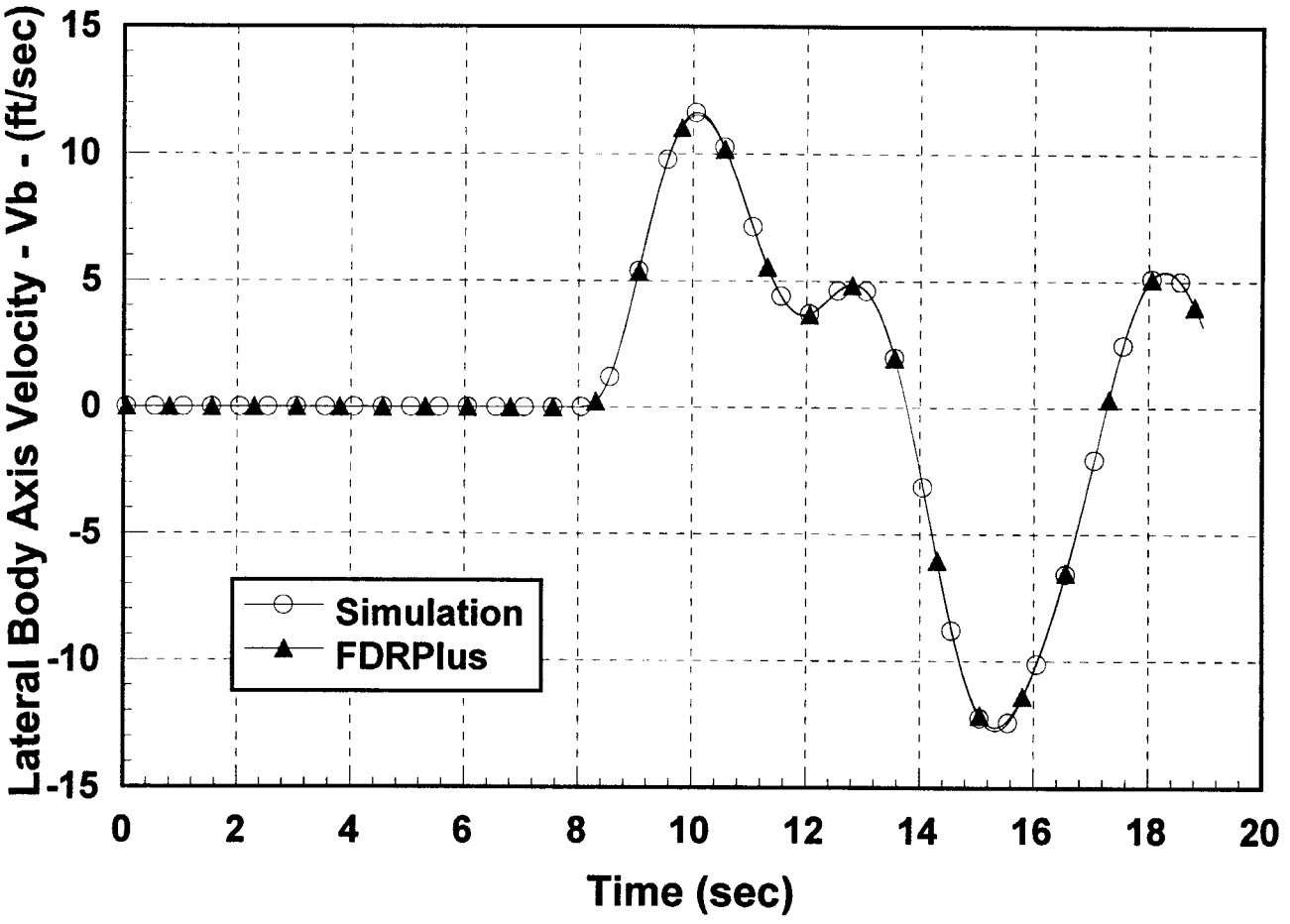
FDRPlus Validation
Beta from trace option



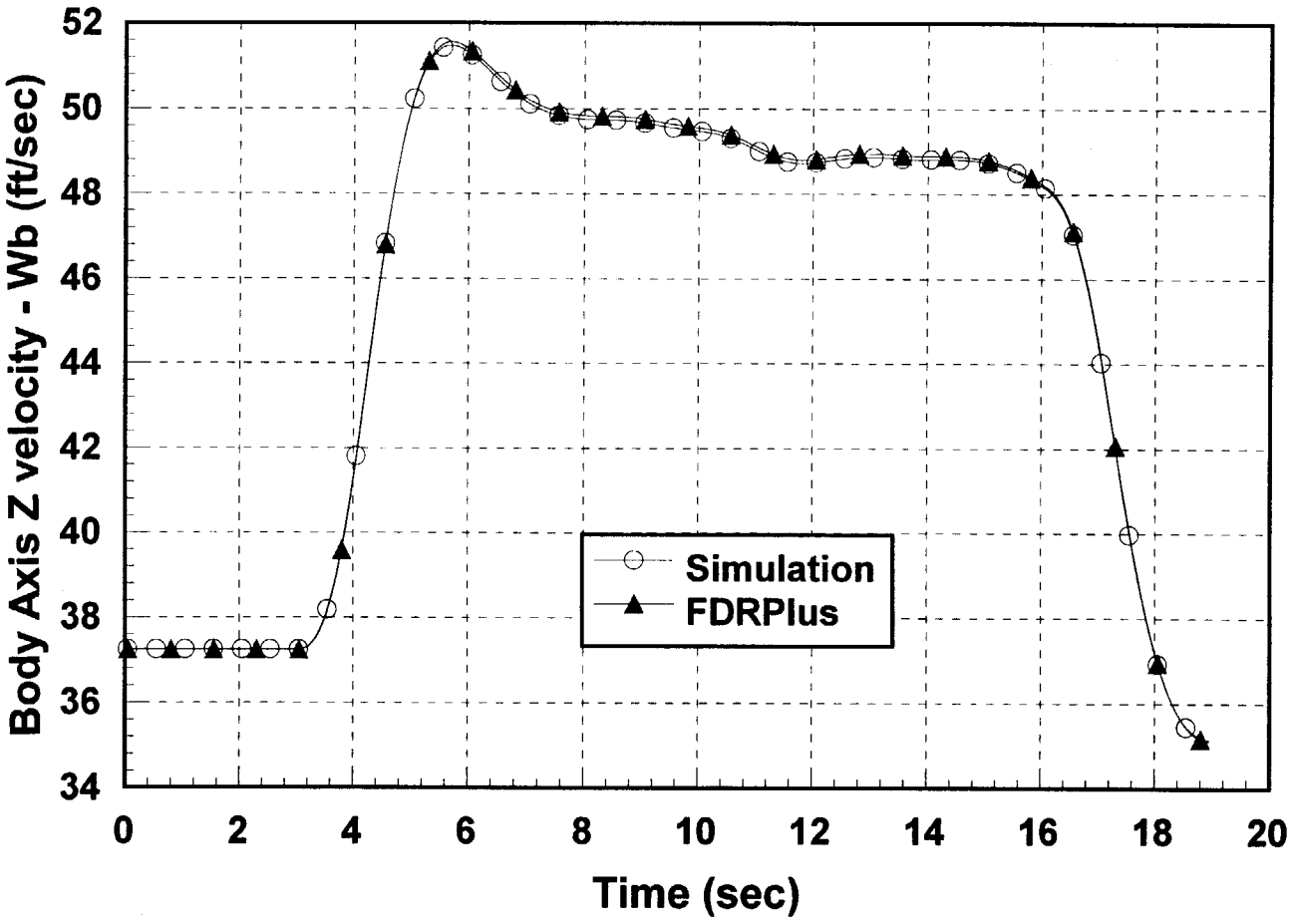
FDRPlus Validation
Beta from trace option



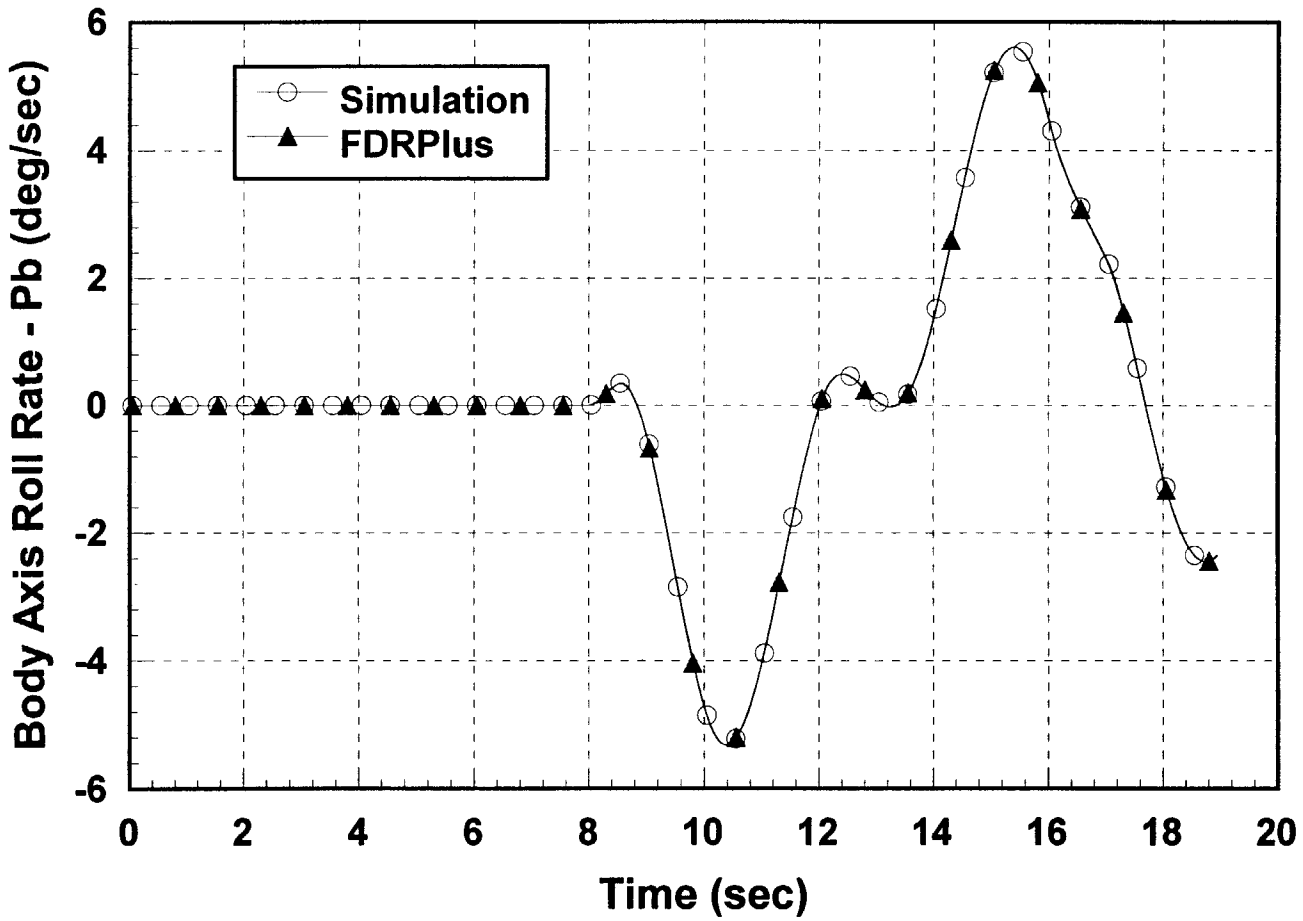
FDRPlus Validation
Beta from trace option



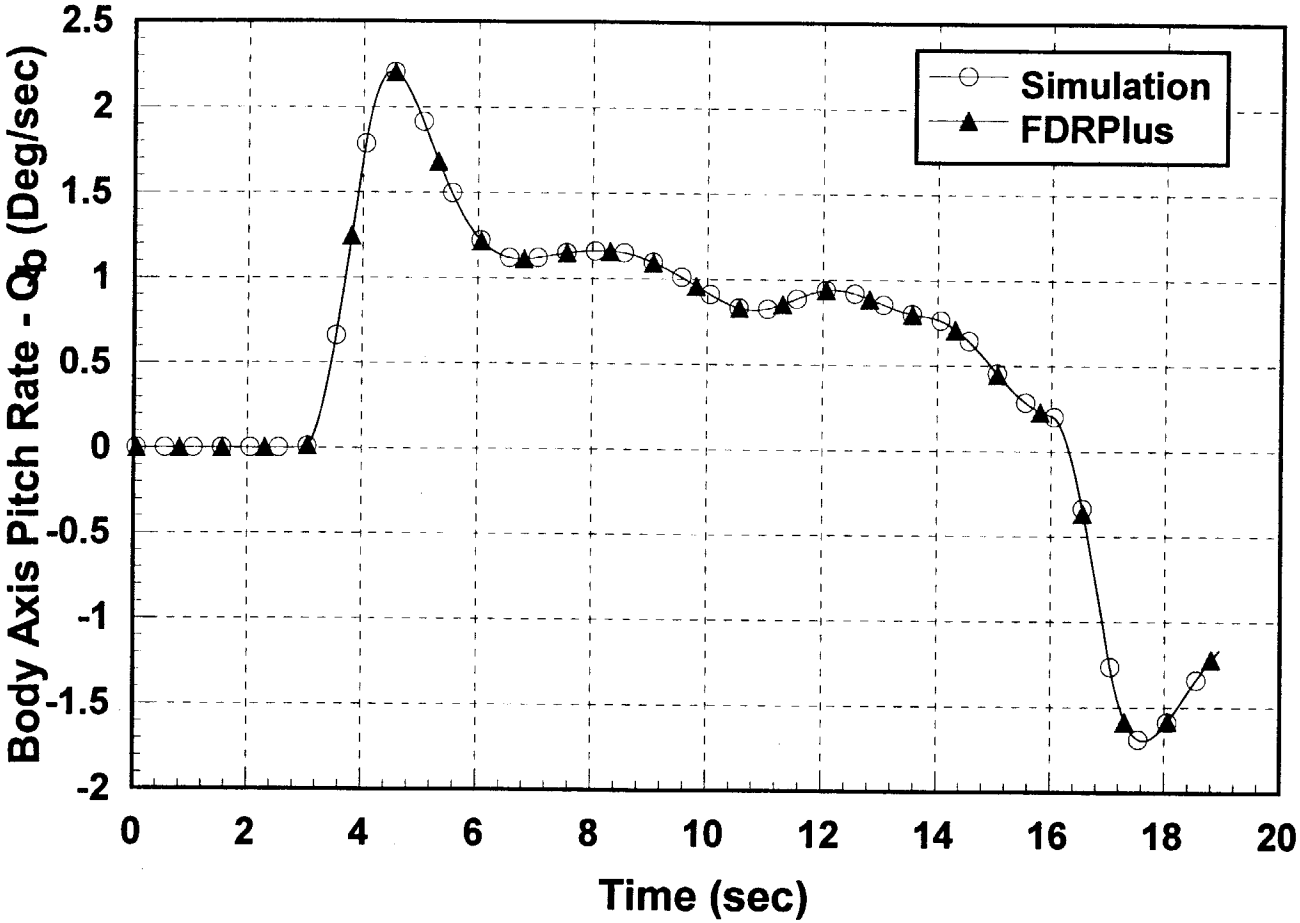
FDRPlus Validation
Beta from trace option



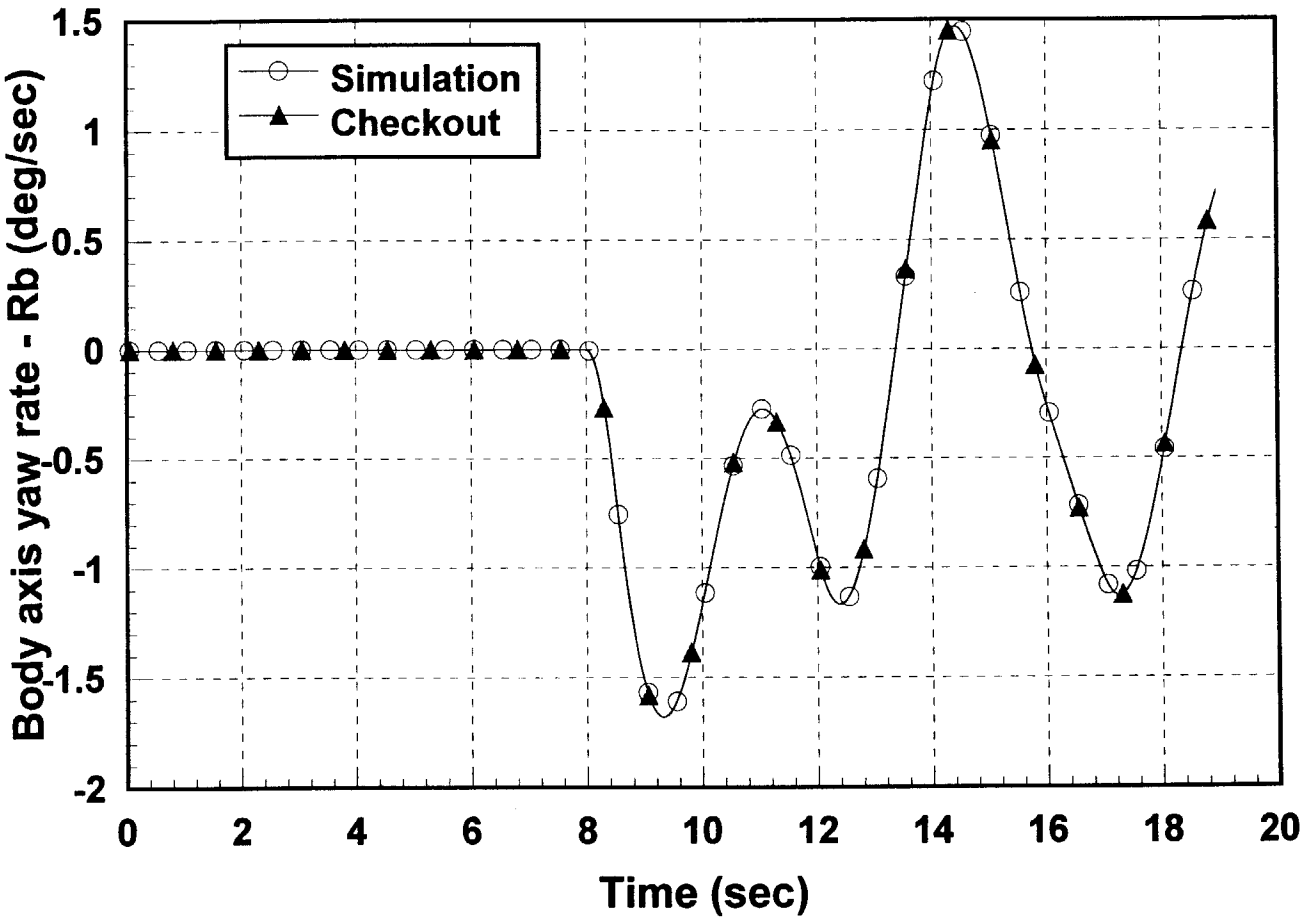
FDRPlus Validation
Beta from trace option



FDRPlus Validation
Beta from trace option

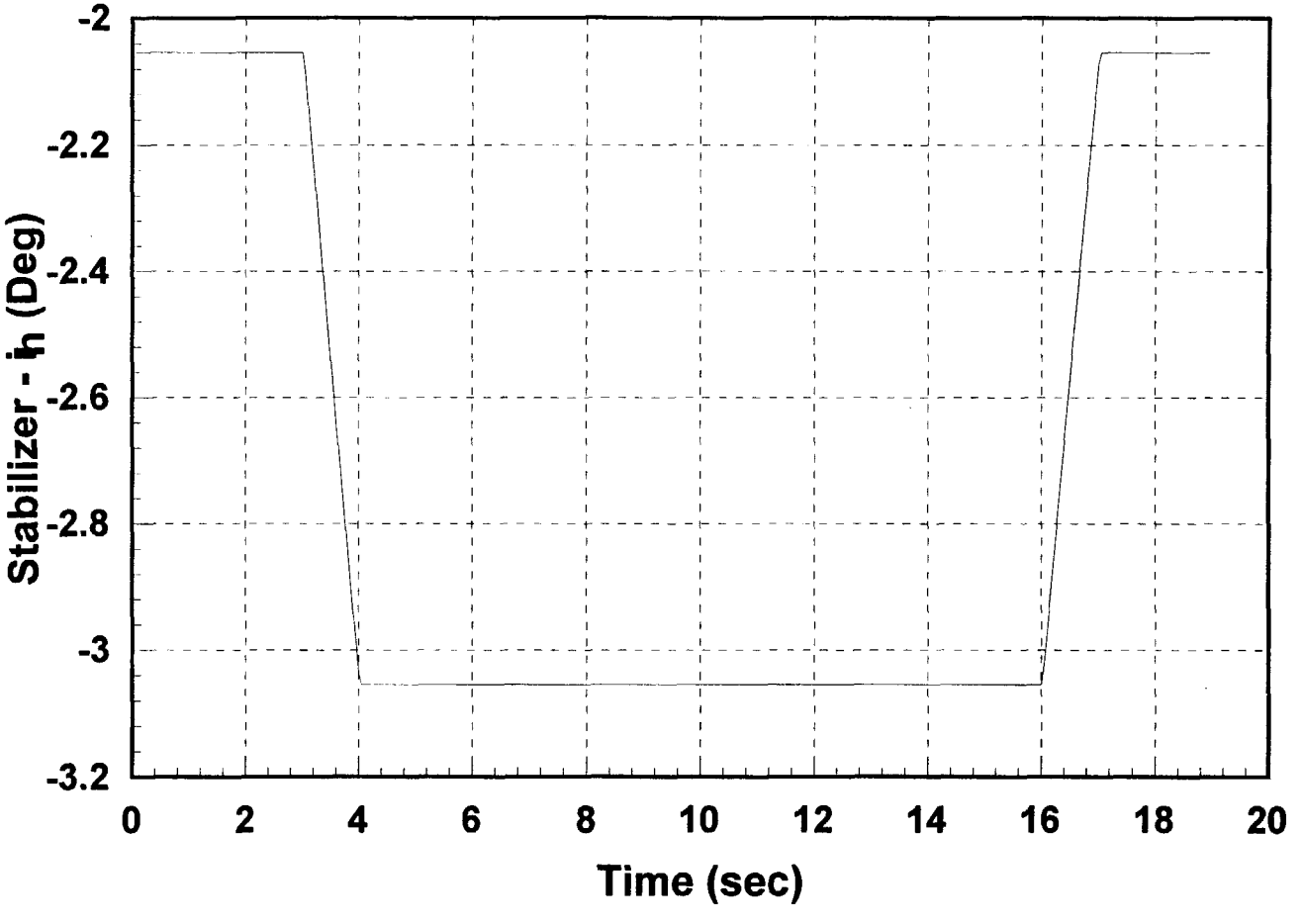


FDRPlus Validation
Beta from trace option



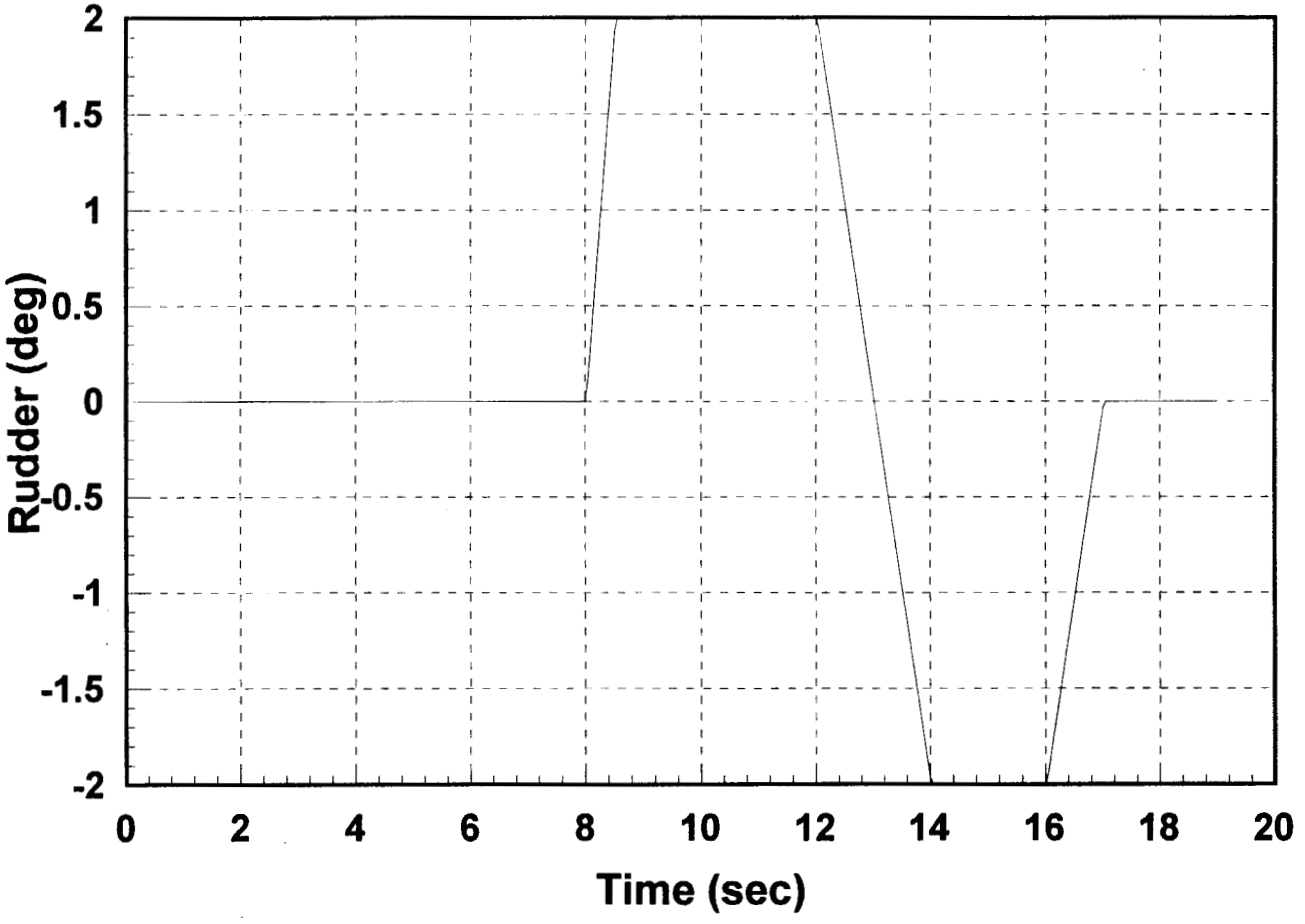
FDRPlus Validation
Beta from trace option

Control Input to Simulation



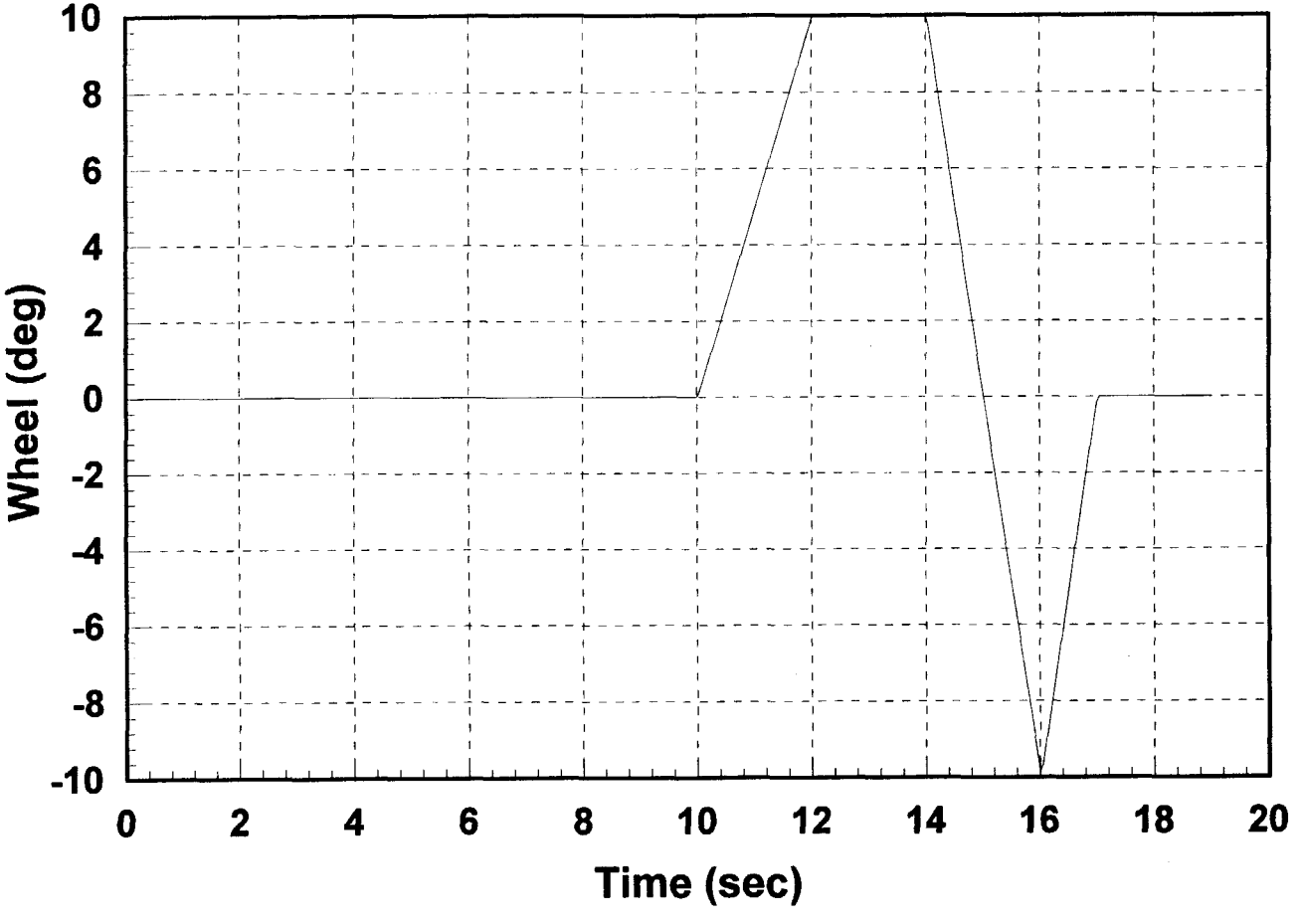
FDRPlus Validation
Beta from trace option

Control Input to Simulation



FDRPlus Validation
Beta from trace option

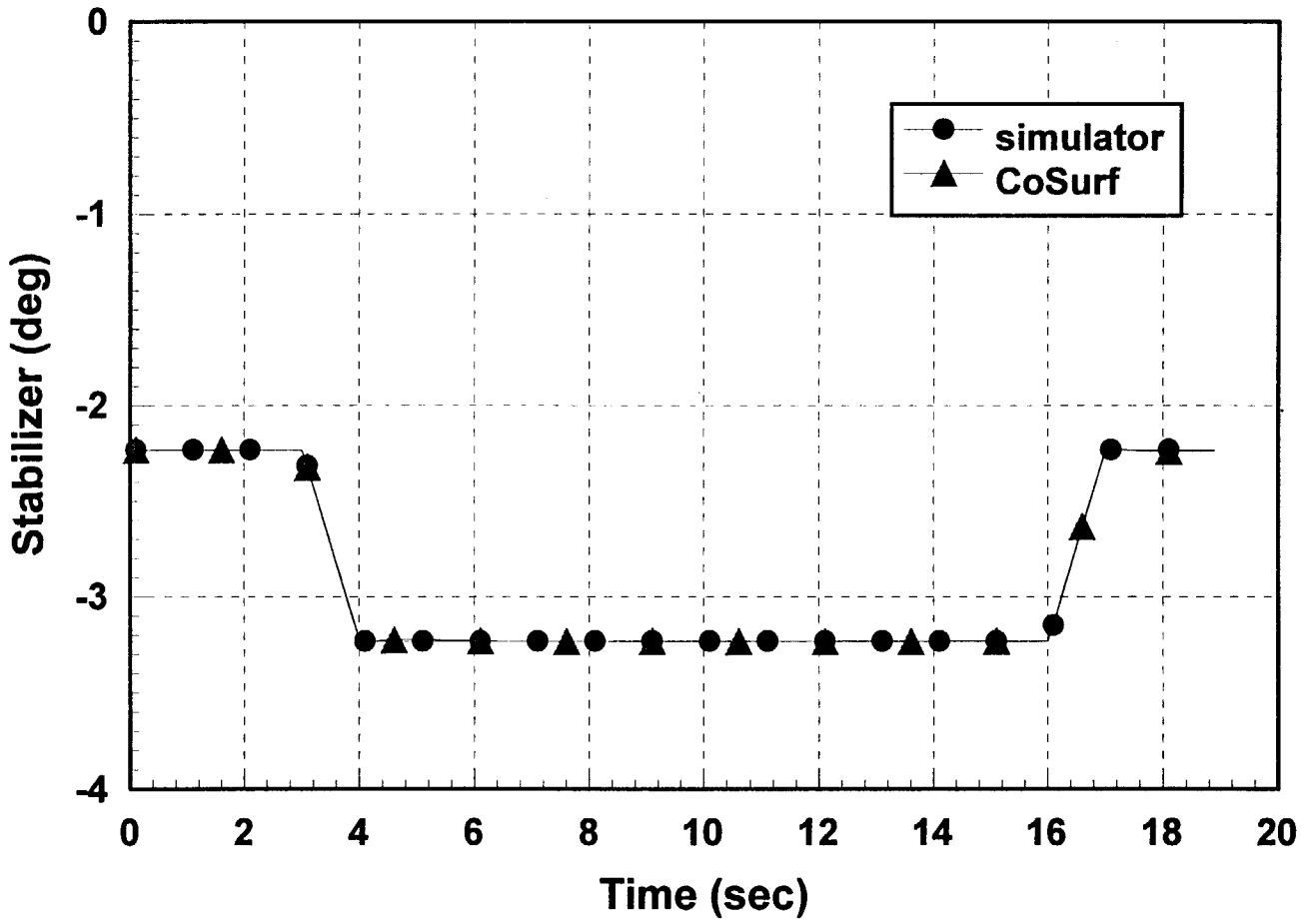
Control Input to Simulation



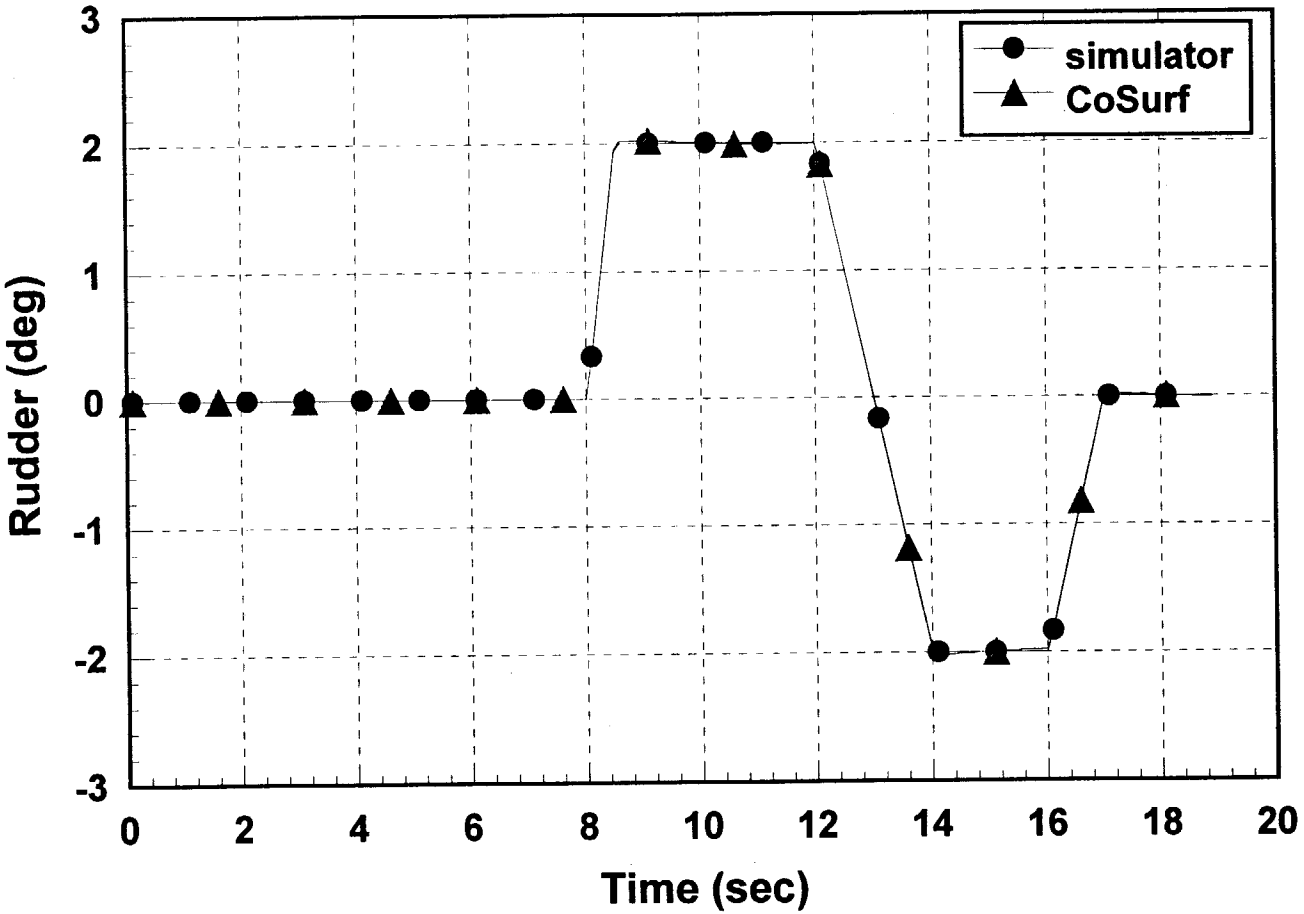
CoSurf program Validation

The CoSurf code was validated by using the 737-300 simulation to generate aerodynamic coefficients and other parameters required as input by the CoSurf code. These parameters were input into CoSurf and the resulting control time histories compared to the control time histories that drove the simulation. The results are presented on the following pages.

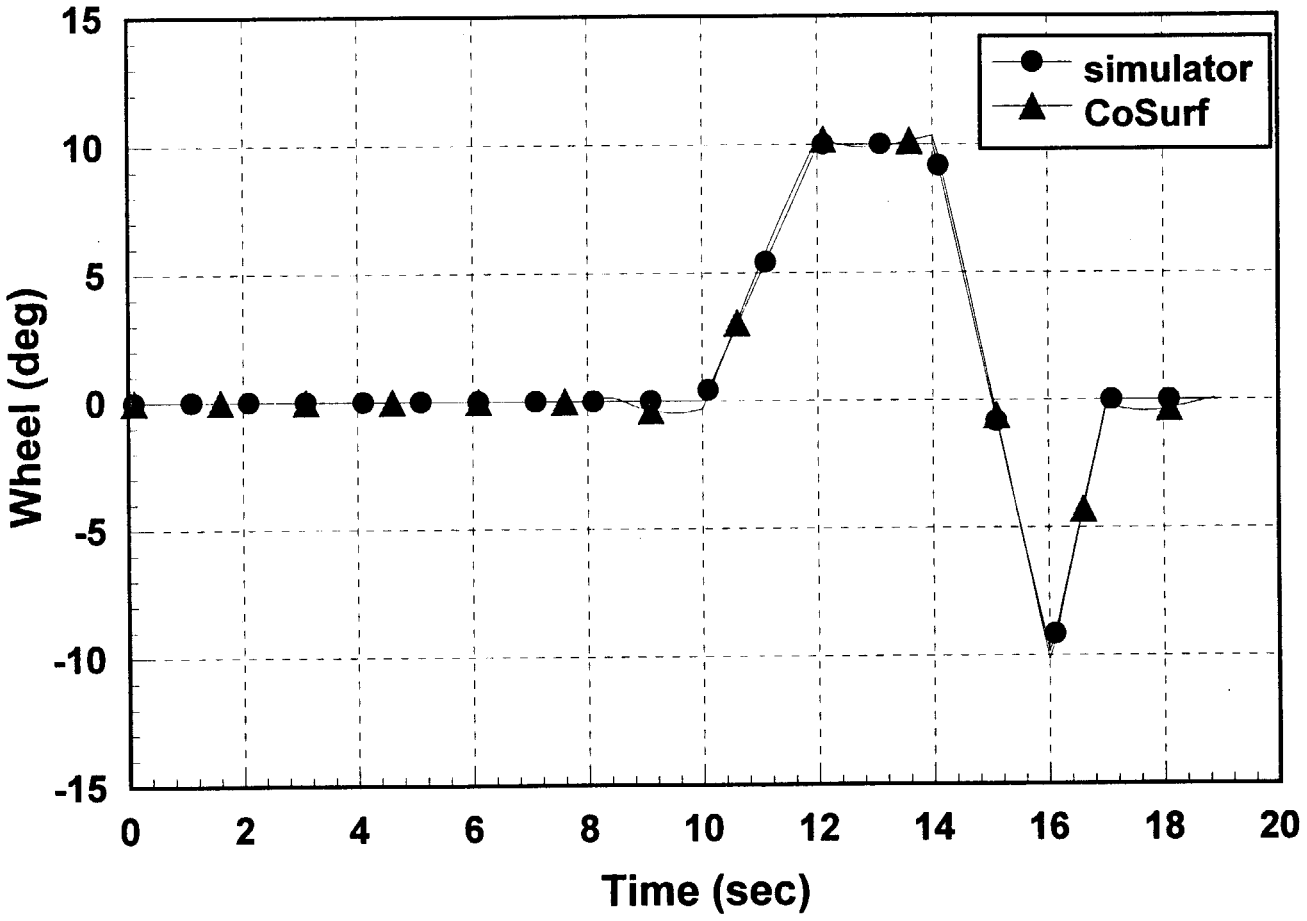
CoSurf Validation
Simulation Aero Coefficients Input
Case 1
Stabilizer Pitch Control



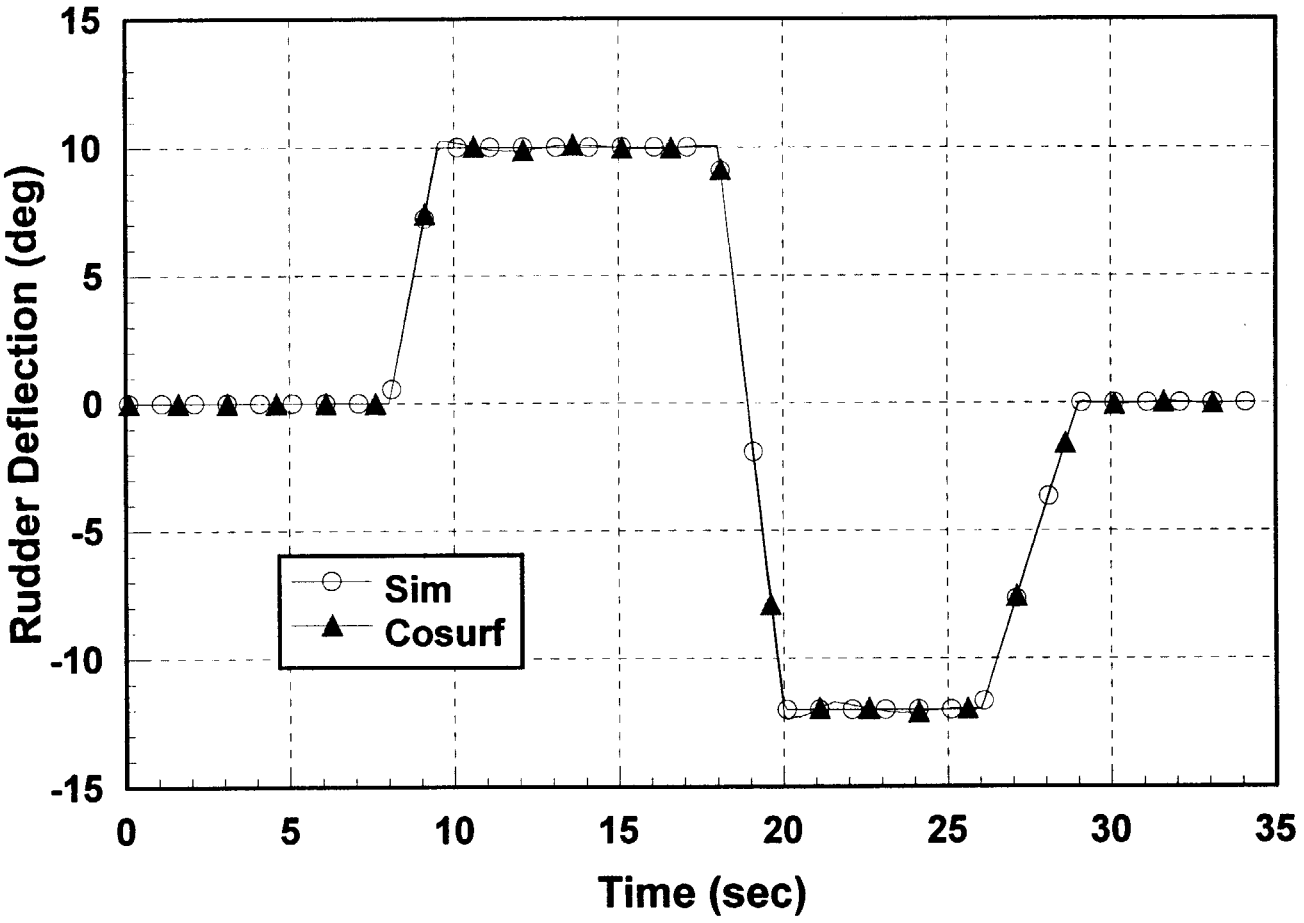
CoSurf Validation
Simulation Aero Coefficients Input
Case 1
Stabilizer Pitch Control



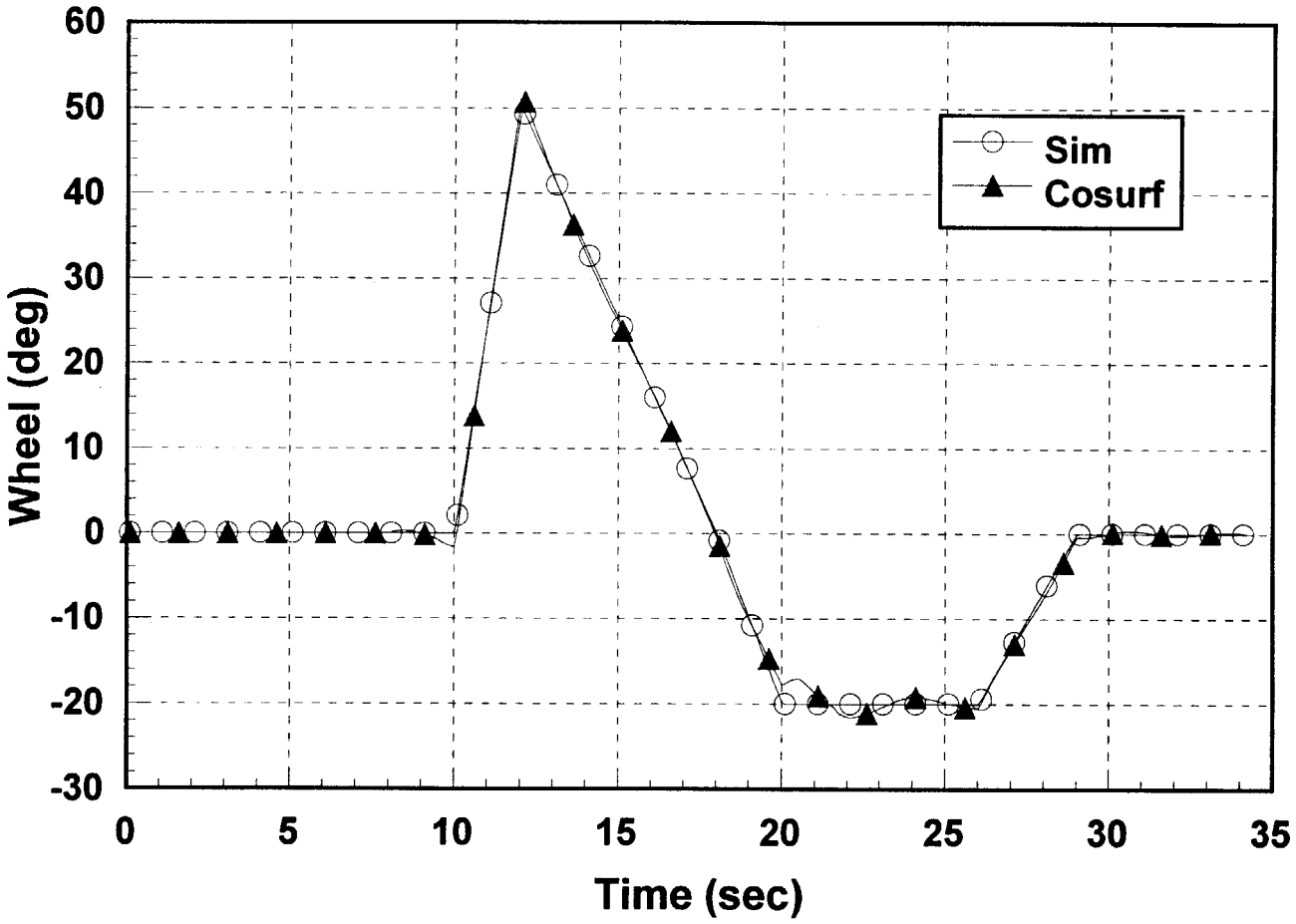
CoSurf Validation
Simulation Aero Coefficients Input
Case 1
Stabilizer Pitch Control



CoSurf Validation
Simulation AeroCoefficient Input
Case 2
Elevator Pitch Control



CoSurf Validation
Simulation AeroCoefficient Input
Case 2
Elevator Pitch Control



CoSurf Validation
Simulation AeroCoefficient Input
Case 2
Elevator Pitch Control