List of Figures

1.1 Volvo VN Heavy Truck Test Vehicle ......................................................... 2
1.2 Damping Compromise for Passive Dampers ............................................. 5
1.3 Passive and Active Suspensions ............................................................... 6
1.4 Passive and Active Suspension Comparison ............................................. 6
1.5 A Quarter-Car Model .............................................................................. 7
1.6 Adjustable Suspension ............................................................................ 8
1.7 Passive and Semiactive Suspensions ....................................................... 9
1.8 Quarter-Car Model with Skyhook Damper ............................................... 9
1.9 Skyhook Control Policy ........................................................................... 10
1.10 Range of Damping Values ..................................................................... 11
1.11 Bilinear Force vs. Velocity Curve for a Conventional Damper ......... 12
1.12 Twin-Tube and Monotube Dampers ...................................................... 12
1.13 Damping Range of a Controllable Damper ............................................ 14
1.14 MR Vibration Absorber for Use in a Controllable Mount ............... 16
1.15 MR Damper for Seismic Control ........................................................... 16
1.16 MR Rotary Brake .................................................................................. 16
1.17 Magnetorheological and Standard Heavy Truck Damper .................... 18
1.18 Structure of MR Damper Used .............................................................. 18
1.19 Conventional Twin-Tube Damper Flow Direction ............................ 19
1.20 MR Damper Flow Direction ................................................................ 20
1.21 Outer Shock, Wire Passage, Fitting, and Lower End Cap .................. 20
1.22 High Pressure Tubing, Fitting, and Clamps ......................................... 20
1.23 Seal Plug ............................................................................................... 22
1.24 Closed Cell Foam Accumulator Used on the Inner Shock Tube .......... 23
1.25 Piston and Piston Rod Shown with O-Rings and Teflon Band ........... 24
1.26 Upper Coil Assembly .......................................................................... 24
1.27 Lower Coil Assembly .......................................................................... 25
1.28 Lower Coil Detail .................................................................................. 26
1.29 MR Damper Main Subassemblies ....................................................... 27
4.18 Sample Plot of Acceleration Data for Channel 10…………………………………… 49
4.19 Acceleration Results: Average Peak Acceleration Amplitude for the Test Vehicle w/MR Dampers and Sky Hook Control Policy………………………………………………………… 50
4.20 Acceleration Results: Average RMS Acceleration for the Test Vehicle w/MR Dampers and Sky Hook Control Policy………………………………………………………… 50
4.21 Acceleration Results: Average Peak Acceleration Amplitude for the Test Vehicle w/MR Dampers Operated in the On State………………………………………………………… 51
4.22 Acceleration Results: Average RMS Acceleration for the Test Vehicle w/MR Dampers Operated in the On State………………………………………………………… 51
4.23 Acceleration Results: Average Peak Acceleration Amplitude for the Test Vehicle w/MR Dampers Operated in the Off State………………………………………………………… 52
4.24 Acceleration Results: Average RMS Acceleration for the Test Vehicle w/MR Dampers Operated in the Off State………………………………………………………… 52
4.25 Acceleration Results: Average Peak Acceleration Amplitude for the Test Vehicle with Original Dampers in Place………………………………………………………… 53
4.26 Acceleration Results: Average RMS Acceleration for the Test Vehicle with Original Dampers in Place………………………………………………………… 53
4.27 Front Passenger-Side Frame Displacement Sample Plots…………………………… 55
4.28 Front Passenger-Side Axle Displacement Sample Plots…………………………… 56
4.29 Rear Passenger-Side Frame Displacement Sample Plots…………………………… 57
4.30 Rear Passenger-Side Axle Displacement Sample Plots…………………………… 58
4.31 B-Post Roll Displacement Sample Plots……………………………………………… 59
4.32 B-Post Roll Displacement Sample Plots……………………………………………… 60
4.33 B-Post Roll Displacement Sample Plots……………………………………………… 61
4.34 Displacement Results: Average Peak Displacement Amplitude for the Test Vehicle w/MR Dampers and Skyhook Control Policy………………………………………………………… 62
4.35 Displacement Results: Average RMS Displacement for the Test Vehicle w/MR Dampers and Skyhook Control Policy………………………………………………………… 63
4.36 Displacement Results: Average Peak Displacement Amplitude for the Test Vehicle w/MR Dampers Operated in the On State………………………………………………………… 63
4.37 Displacement Results: Average RMS Displacement for the Test Vehicle w/MR
Dampers Operated in the On State

4.38 Displacement Results: Average Peak Displacement Amplitude for the Test Vehicle w/MR Dampers Operated in the Off State

4.39 Displacement Results: Average RMS Displacement for the Test Vehicle w/MR Dampers Operated in the Off State

4.40 Displacement Results: Average Peak Displacement Amplitude for the Test Vehicle with Original Dampers in Place

4.41 Displacement Results: Average RMS Displacement Amplitude for the Test Vehicle with Original Dampers in Place

4.42 Average Peak Acceleration Comparison

4.43 Average RMS Acceleration Comparison

4.44 Average Peak Displacement Comparison

4.45 Average RMS Displacement Comparison

4.46 Average Peak Intensity in the 1-4 Hz Frequency Band

4.47 Average Peak Intensity in the 4-9 Hz Frequency Band

4.48 Average Peak Intensity in the 9-14 Hz Frequency Band

4.49 Average Peak Intensity in the 14-19 Hz Frequency Band

4.50 Percent Increase of Average Peak Intensity: MR Active vs. Original (Transient)

4.51 RMS Acceleration Results for Steady State Data

4.52 Average Peak Intensity in the 1-4 Hz Frequency Band

4.53 Average Peak Intensity in the 4-9 Hz Frequency Band

4.54 Average Peak Intensity in the 9-14 Hz Frequency Band

4.55 Average Peak Intensity in the 14-19 Hz Frequency Band

4.56 Percent Increase of RMS Acceleration: MR Active vs. Original (Steady State)

4.57 Percent Increase of Average Peak Intensity: MR Active vs. Original (Steady State)