# APPENDIX A

# KINEMATIC, KINETIC, AND ENERGY DATA

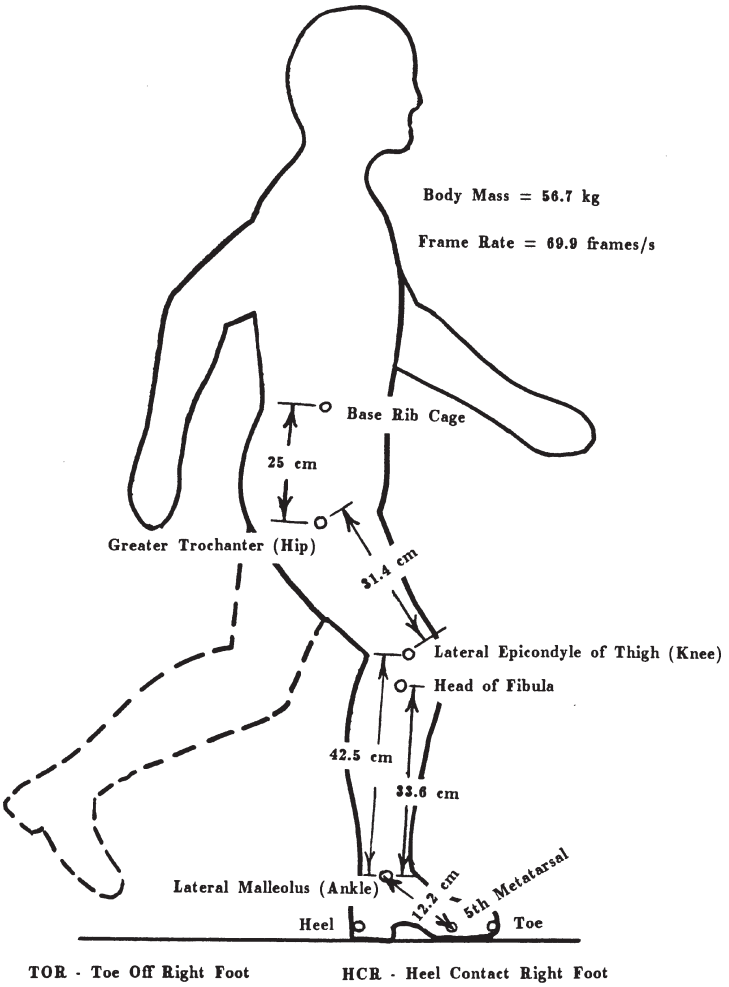


**Figure A.1** Walking trial—marker locations and mass and frame rate information.


 ISBN: 978-0-470-39818-0

**TABLE A.1 Raw Coordinate Data (cm)**

| FRAME | TIME S | BASE RIB X | CAGE Y | RIGHT X | HIP Y | RIGHT X | KNEE Y | RIGHT X | FIBULA Y | RIGHT X | ANKLE Y | RIGHT X | HEEL Y | RIGHT X | METAT. Y | RIGHT X | TOE Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.000 | 46.98 | 104.41 | 44.94 | 78.58 | 41.00 | 47.40 | 35.91 | 40.53 | 9.31 | 21.44 | 2.95 | 24.24 | 7.53 | 9.35 | 11.73 | 3.63 |
| 2 | 0.014 | 49.22 | 104.79 | 47.31 | 78.58 | 45.02 | 46.89 | 40.06 | 40.02 | 12.70 | 22.46 | 7.23 | 26.02 | 10.54 | 10.63 | 13.72 | 4.77 |
| 3 | 0.029 | 51.10 | 105.17 | 49.57 | 78.71 | 48.68 | 47.27 | 44.23 | 40.15 | 16.49 | 23.73 | 10.64 | 27.30 | 14.20 | 12.03 | 17.63 | 6.43 |
| 4 | 0.043 | 53.13 | 105.30 | 51.74 | 79.21 | 52.50 | 47.53 | 48.43 | 40.15 | 20.81 | 24.37 | 14.71 | 27.55 | 18.78 | 12.53 | 22.47 | 6.94 |
| 5 | 0.057 | 54.86 | 105.43 | 53.33 | 79.09 | 56.13 | 47.91 | 52.70 | 40.78 | 24.96 | 24.24 | 18.72 | 27.42 | 23.17 | 12.66 | 27.12 | 7.32 |
| 6 | 0.072 | 56.81 | 106.06 | 55.41 | 79.98 | 59.87 | 48.67 | 56.56 | 41.29 | 29.33 | 24.62 | 23.09 | 27.17 | 28.31 | 12.41 | 32.51 | 6.81 |
| 7 | 0.086 | 58.25 | 106.32 | 56.73 | 80.49 | 63.34 | 49.44 | 60.29 | 41.80 | 33.57 | 23.73 | 26.95 | 26.02 | 33.44 | 12.03 | 38.02 | 6.81 |
| 8 | 0.100 | 60.03 | 106.95 | 58.89 | 81.00 | 66.90 | 50.84 | 64.36 | 42.69 | 38.78 | 23.22 | 31.27 | 25.01 | 39.55 | 11.26 | 44.38 | 6.30 |
| 9 | 0.114 | 61.56 | 107.08 | 60.79 | 81.12 | 69.96 | 51.09 | 67.79 | 43.20 | 43.11 | 22.21 | 35.73 | 22.84 | 45.01 | 10.24 | 50.36 | 6.04 |
| 10 | 0.129 | 63.54 | 107.46 | 62.78 | 82.01 | 73.22 | 51.73 | 71.31 | 43.84 | 48.15 | 21.06 | 40.64 | 20.93 | 51.46 | 8.97 | 57.05 | 5.28 |
| 11 | 0.143 | 65.20 | 107.85 | 64.69 | 82.40 | 76.27 | 53.00 | 74.74 | 44.86 | 53.23 | 20.04 | 45.73 | 19.02 | 57.56 | 8.21 | 63.54 | 5.15 |
| 12 | 0.157 | 66.92 | 107.85 | 66.67 | 82.78 | 79.01 | 53.51 | 77.86 | 45.11 | 58.27 | 18.52 | 51.27 | 16.86 | 63.99 | 7.44 | 70.23 | 5.03 |
| 13 | 0.172 | 68.77 | 107.59 | 68.65 | 82.65 | 81.62 | 54.15 | 80.73 | 45.49 | 63.68 | 16.86 | 56.56 | 14.44 | 70.30 | 6.30 | 76.79 | 4.52 |
| 14 | 0.186 | 70.37 | 107.59 | 70.88 | 83.16 | 83.99 | 54.53 | 83.48 | 45.87 | 69.22 | 15.59 | 62.23 | 12.66 | 76.73 | 5.79 | 83.48 | 4.77 |
| 15 | 0.200 | 72.43 | 107.59 | 73.19 | 82.90 | 86.56 | 54.78 | 86.30 | 46.00 | 74.72 | 14.44 | 68.23 | 11.01 | 83.63 | 5.66 | 90.12 | 5.54 |
| 16 | 0.215 | 74.00 | 107.59 | 74.89 | 83.03 | 88.51 | 54.91 | 88.89 | 46.13 | 80.36 | 13.43 | 74.13 | 9.10 | 89.53 | 5.28 | 96.14 | 5.54 |
| 17 | 0.229 | 75.68 | 107.59 | 76.95 | 82.90 | 90.57 | 54.91 | 90.95 | 45.87 | 85.86 | 12.66 | 80.01 | 7.57 | 95.53 | 5.79 | 102.40 | 6.55 |
| 18 | 0.243 | 77.67 | 107.08 | 79.19 | 82.65 | 93.06 | 54.65 | 93.32 | 46.00 | 91.54 | 12.03 | 86.32 | 6.55 | 101.72 | 5.79 | 108.84 | 7.70 |
| 19 | 0.257 | 79.55 | 106.95 | 81.20 | 82.40 | 94.56 | 54.02 | 95.45 | 45.62 | 96.85 | 11.64 | 92.02 | 5.41 | 107.79 | 6.17 | 114.16 | 8.97 |
| 20 | 0.272 | 81.47 | 107.21 | 83.12 | 82.14 | 96.10 | 54.02 | 96.99 | 45.24 | 101.45 | 11.77 | 97.50 | 5.15 | 113.28 | 7.70 | 119.39 | 10.88 |
| 21 | 0.286 | 83.53 | 106.45 | 85.69 | 81.50 | 98.16 | 53.25 | 99.18 | 44.73 | 106.56 | 11.77 | 103.13 | 4.77 | 118.78 | 8.21 | 124.38 | 12.15 |
| 22 | 0.300 | 85.86 | 105.68 | 87.77 | 80.49 | 99.73 | 51.86 | 101.13 | 43.84 | 110.68 | 11.52 | 108.39 | 4.14 | 123.15 | 9.35 | 128.24 | 13.30 |
| 23 | 0.315 | 87.74 | 105.81 | 89.91 | 80.61 | 101.36 | 51.73 | 103.14 | 43.71 | 114.85 | 12.15 | 112.43 | 4.90 | 126.94 | 10.88 | 131.77 | 15.33 |
| 24 | 0.329 | 90.34 | 105.17 | 92.25 | 80.49 | 103.57 | 51.09 | 105.36 | 43.58 | 118.33 | 12.15 | 116.30 | 5.28 | 130.55 | 11.39 | 135.39 | 16.23 |
| 25 | 0.343 | 92.25 | 104.79 | 94.41 | 80.10 | 105.23 | 50.96 | 107.26 | 43.46 | 120.75 | 12.28 | 118.84 | 4.65 | 133.22 | 11.64 | 137.80 | 16.73 |
| 26 | 0.357 | 94.36 | 104.16 | 97.03 | 79.72 | 107.59 | 50.84 | 109.50 | 42.69 | 122.99 | 12.03 | 121.34 | 4.14 | 135.21 | 11.39 | 139.79 | 16.23 |
| 27 | 0.372 | 96.57 | 103.77 | 99.37 | 79.98 | 109.93 | 50.58 | 111.58 | 42.95 | 124.31 | 11.90 | 122.14 | 3.75 | 136.27 | 10.37 | 140.85 | 15.21 |

*(continued)*

**TABLE A.1** *(Continued)*

| FRAME | TIME S | BASE RIB X | CAGE Y | RIGHT X | HIP Y | RIGHT X | KNEE Y | RIGHT X | FIBULA Y | RIGHT X | ANKLE Y | RIGHT X | HEEL Y | RIGHT X | METAT. Y | RIGHT X | TOE Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 0.386 | 98.73 | 103.52 | 101.53 | 79.34 | 112.34 | 50.46 | 113.87 | 41.80 | 124.94 | 10.63 | 122.65 | 3.25 | 137.16 | 8.97 | 141.99 | 13.68 |
| 29 | 0.400 | 101.40 | 103.26 | 104.45 | 79.60 | 114.89 | 50.33 | 116.28 | 41.80 | 125.83 | 9.61 | 123.03 | 3.50 | 137.66 | 7.95 | 142.88 | 11.90 |
| 30 | 0.415 | 103.60 | 103.65 | 106.78 | 79.60 | 116.96 | 50.46 | 118.11 | 41.80 | 127.02 | 9.74 | 123.20 | 4.14 | 138.34 | 6.30 | 144.45 | 10.24 |
| 31 | 0.429 | 105.94 | 103.65 | 108.86 | 79.60 | 118.53 | 50.33 | 119.81 | 41.55 | 127.82 | 9.48 | 123.12 | 4.01 | 138.77 | 5.41 | 145.13 | 8.59 |
| 32 | 0.443 | 108.22 | 103.52 | 111.28 | 80.10 | 120.44 | 50.58 | 121.71 | 42.18 | 128.33 | 9.61 | 123.24 | 4.14 | 139.27 | 4.65 | 145.38 | 6.81 |
| 33 | 0.458 | 110.75 | 104.03 | 113.80 | 80.49 | 122.84 | 50.96 | 124.24 | 42.44 | 129.07 | 9.35 | 123.60 | 4.14 | 139.51 | 4.14 | 146.38 | 6.30 |
| 34 | 0.472 | 112.91 | 104.03 | 115.58 | 81.38 | 125.25 | 51.86 | 126.14 | 42.57 | 129.45 | 9.61 | 123.98 | 4.39 | 139.63 | 3.37 | 146.25 | 5.41 |
| 35 | 0.486 | 115.20 | 104.28 | 117.36 | 81.89 | 127.54 | 51.86 | 128.05 | 42.44 | 129.83 | 9.74 | 123.98 | 4.26 | 140.01 | 3.63 | 147.14 | 5.41 |
| 36 | 0.500 | 116.74 | 104.54 | 118.78 | 81.63 | 128.32 | 51.86 | 128.83 | 42.69 | 129.46 | 9.10 | 123.48 | 4.14 | 139.39 | 3.75 | 146.52 | 4.77 |
| 37 | 0.515 | 119.05 | 105.43 | 120.96 | 81.63 | 129.87 | 51.86 | 130.13 | 42.95 | 129.74 | 9.35 | 123.89 | 4.65 | 139.80 | 3.63 | 146.54 | 4.90 |
| 38 | 0.529 | 121.31 | 105.30 | 123.10 | 82.27 | 130.86 | 51.60 | 131.49 | 42.18 | 130.10 | 9.23 | 124.24 | 4.52 | 140.02 | 3.75 | 147.27 | 4.52 |
| 39 | 0.543 | 123.28 | 106.19 | 124.93 | 83.03 | 132.18 | 52.36 | 132.31 | 42.82 | 130.53 | 9.61 | 124.55 | 4.90 | 140.45 | 3.75 | 147.33 | 5.28 |
| 40 | 0.558 | 125.03 | 106.19 | 126.94 | 82.78 | 133.04 | 51.35 | 132.79 | 42.44 | 130.37 | 9.35 | 124.64 | 4.26 | 140.55 | 3.50 | 147.04 | 4.77 |
| 41 | 0.572 | 127.21 | 106.83 | 128.61 | 83.03 | 133.58 | 51.73 | 132.81 | 42.44 | 130.27 | 9.61 | 124.67 | 4.77 | 139.94 | 3.63 | 147.19 | 4.52 |
| 42 | 0.586 | 128.71 | 106.95 | 130.24 | 83.03 | 134.31 | 51.35 | 133.17 | 43.20 | 129.98 | 8.97 | 123.75 | 4.77 | 139.91 | 3.37 | 146.91 | 4.77 |
| 43 | 0.601 | 130.90 | 107.34 | 132.04 | 82.90 | 134.72 | 50.96 | 133.70 | 42.57 | 130.39 | 9.61 | 124.54 | 4.14 | 140.19 | 3.50 | 147.31 | 4.52 |
| 44 | 0.615 | 132.52 | 107.97 | 133.03 | 83.41 | 135.70 | 52.62 | 134.56 | 43.20 | 130.23 | 9.61 | 124.12 | 4.52 | 139.90 | 4.01 | 146.78 | 4.26 |
| 45 | 0.629 | 134.48 | 107.85 | 134.86 | 83.54 | 136.26 | 51.86 | 134.73 | 42.95 | 129.89 | 9.48 | 123.91 | 4.77 | 139.82 | 3.63 | 146.95 | 4.26 |
| 46 | 0.643 | 136.33 | 108.10 | 136.20 | 83.80 | 137.09 | 51.86 | 135.18 | 43.07 | 130.22 | 10.24 | 124.37 | 4.90 | 140.02 | 3.37 | 147.02 | 4.77 |
| 47 | 0.658 | 138.33 | 108.23 | 138.08 | 82.90 | 137.95 | 51.47 | 135.66 | 42.69 | 130.06 | 9.99 | 124.08 | 4.77 | 140.11 | 3.75 | 146.99 | 4.26 |
| 48 | 0.672 | 140.14 | 108.48 | 139.38 | 82.90 | 138.74 | 51.60 | 136.19 | 42.69 | 130.47 | 10.12 | 124.36 | 5.03 | 140.01 | 3.25 | 147.01 | 4.01 |
| 49 | 0.686 | 142.20 | 107.97 | 140.67 | 82.78 | 139.15 | 51.09 | 136.73 | 42.57 | 130.49 | 9.99 | 124.64 | 5.28 | 140.16 | 3.12 | 147.04 | 4.52 |
| 50 | 0.701 | 144.05 | 107.46 | 142.02 | 82.65 | 140.11 | 51.09 | 137.05 | 42.57 | 130.56 | 9.99 | 124.20 | 4.90 | 139.60 | 3.63 | 146.85 | 4.01 |
| 51 | 0.715 | 146.01 | 107.08 | 143.85 | 82.01 | 140.92 | 50.58 | 137.87 | 42.06 | 130.49 | 10.24 | 124.76 | 4.77 | 140.03 | 3.50 | 147.28 | 3.75 |
| 52 | 0.729 | 148.58 | 107.46 | 146.04 | 82.40 | 142.22 | 50.84 | 138.66 | 42.44 | 131.27 | 10.24 | 125.17 | 5.28 | 140.18 | 3.63 | 147.18 | 4.14 |
| 53 | 0.744 | 149.92 | 106.57 | 147.51 | 81.63 | 143.05 | 50.58 | 139.23 | 41.93 | 130.96 | 10.12 | 125.24 | 5.03 | 140.25 | 3.37 | 147.25 | 4.01 |
| 54 | 0.758 | 152.34 | 106.32 | 148.90 | 81.50 | 143.69 | 50.71 | 140.12 | 42.57 | 131.47 | 10.63 | 125.49 | 5.66 | 140.50 | 3.37 | 147.50 | 3.88 |
| 55 | 0.772 | 153.94 | 105.81 | 150.50 | 81.12 | 144.27 | 50.46 | 140.45 | 42.95 | 131.03 | 10.63 | 124.80 | 6.17 | 140.07 | 2.99 | 146.94 | 3.75 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 0.786 | 156.15 | 105.30 | 152.46 | 81.00 | 145.59 | 50.71 | 141.52 | 42.31 | 131.34 | 10.63 | 125.61 | 5.92 | 140.50 | 3.37 | 147.24 | 3.88 |
| 57 | 0.801 | 158.65 | 104.92 | 154.57 | 81.00 | 147.07 | 50.58 | 142.61 | 42.18 | 131.80 | 10.75 | 125.94 | 7.06 | 140.70 | 3.50 | 147.45 | 3.75 |
| 58 | 0.815 | 160.50 | 104.66 | 156.30 | 80.61 | 148.41 | 50.71 | 143.83 | 43.20 | 132.12 | 12.15 | 125.89 | 7.70 | 140.65 | 4.01 | 147.39 | 4.14 |
| 59 | 0.829 | 162.61 | 104.41 | 157.90 | 80.10 | 149.75 | 50.33 | 144.66 | 42.31 | 131.94 | 12.03 | 125.96 | 7.83 | 140.34 | 3.75 | 146.95 | 3.75 |
| 60 | 0.844 | 164.58 | 104.03 | 159.88 | 80.23 | 151.22 | 50.33 | 146.26 | 42.82 | 132.26 | 12.66 | 126.03 | 8.46 | 140.41 | 3.75 | 147.02 | 3.88 |
| 61 | 0.858 | 166.66 | 103.77 | 162.08 | 80.23 | 153.30 | 50.33 | 147.96 | 42.69 | 132.69 | 12.92 | 126.58 | 9.61 | 140.20 | 4.26 | 146.69 | 4.26 |
| 62 | 0.872 | 168.90 | 104.03 | 164.19 | 79.60 | 155.41 | 50.07 | 150.06 | 42.57 | 133.39 | 13.93 | 126.90 | 10.50 | 140.01 | 3.88 | 146.76 | 4.01 |
| 63 | 0.887 | 171.00 | 103.90 | 166.42 | 79.85 | 157.01 | 50.07 | 152.30 | 42.69 | 133.97 | 14.83 | 127.48 | 12.28 | 140.21 | 3.88 | 146.83 | 3.75 |
| 64 | 0.901 | 173.53 | 103.14 | 169.07 | 78.96 | 160.29 | 49.06 | 154.95 | 42.06 | 135.48 | 14.95 | 128.73 | 13.04 | 140.95 | 4.14 | 147.06 | 3.50 |
| 65 | 0.915 | 175.81 | 103.52 | 171.74 | 79.47 | 163.22 | 49.06 | 157.62 | 42.31 | 136.75 | 16.48 | 129.62 | 14.83 | 141.08 | 4.65 | 147.18 | 3.75 |
| 66 | 0.929 | 179.23 | 103.14 | 175.16 | 78.83 | 166.89 | 48.55 | 161.03 | 41.04 | 139.14 | 17.37 | 132.15 | 16.10 | 141.94 | 5.28 | 148.31 | 2.99 |
| 67 | 0.944 | 181.49 | 103.14 | 177.80 | 78.58 | 170.04 | 48.16 | 164.69 | 41.42 | 140.90 | 18.64 | 134.02 | 18.52 | 142.42 | 5.79 | 148.40 | 2.86 |
| 68 | 0.958 | 183.65 | 103.77 | 180.60 | 79.09 | 174.11 | 48.04 | 168.25 | 41.55 | 143.69 | 19.79 | 136.95 | 21.57 | 143.69 | 7.57 | 149.04 | 3.63 |
| 69 | 0.972 | 184.86 | 103.39 | 182.44 | 77.94 | 176.97 | 47.02 | 171.50 | 40.15 | 145.54 | 20.42 | 139.43 | 23.35 | 144.14 | 7.95 | 148.59 | 3.50 |
| 70 | 0.987 | 187.71 | 104.28 | 185.67 | 78.83 | 181.73 | 47.53 | 176.00 | 40.15 | 149.53 | 21.82 | 143.81 | 25.13 | 146.86 | 9.74 | 150.17 | 4.26 |
| 71 | 1.001 | 188.82 | 104.16 | 187.29 | 78.20 | 184.36 | 46.89 | 179.40 | 39.51 | 152.68 | 22.21 | 146.95 | 25.90 | 149.11 | 10.75 | 151.91 | 4.14 |
| 72 | 1.015 | 191.13 | 104.92 | 189.48 | 78.83 | 188.33 | 47.27 | 184.00 | 39.89 | 156.39 | 23.73 | 150.54 | 27.17 | 153.34 | 12.03 | 156.52 | 5.66 |
| 73 | 1.030 | 192.42 | 105.55 | 190.89 | 79.09 | 191.78 | 47.66 | 187.71 | 40.53 | 159.84 | 24.24 | 153.73 | 27.68 | 157.17 | 12.28 | 160.73 | 5.92 |
| 74 | 1.044 | 194.40 | 106.19 | 193.00 | 79.60 | 195.29 | 48.16 | 191.47 | 41.04 | 163.99 | 24.37 | 157.50 | 27.93 | 161.82 | 12.66 | 165.38 | 6.43 |
| 75 | 1.058 | 196.18 | 105.94 | 195.16 | 79.72 | 199.10 | 48.93 | 195.79 | 41.42 | 168.44 | 24.50 | 161.95 | 27.04 | 167.29 | 12.15 | 170.98 | 6.68 |
| 76 | 1.072 | 197.69 | 106.06 | 196.42 | 80.10 | 202.66 | 49.31 | 199.47 | 41.55 | 172.50 | 23.61 | 165.88 | 25.77 | 171.99 | 10.88 | 176.57 | 6.17 |
| 77 | 1.087 | 199.57 | 106.70 | 198.68 | 81.00 | 206.19 | 50.33 | 203.39 | 42.44 | 177.30 | 22.84 | 170.56 | 25.01 | 177.81 | 10.12 | 182.65 | 6.17 |
| 78 | 1.101 | 201.17 | 107.21 | 200.53 | 81.63 | 209.57 | 51.22 | 206.90 | 43.20 | 182.08 | 21.95 | 175.08 | 23.10 | 183.74 | 9.61 | 189.21 | 4.90 |
| 79 | 1.115 | 202.99 | 107.59 | 202.48 | 82.14 | 212.66 | 52.11 | 210.63 | 43.84 | 187.09 | 21.06 | 179.83 | 21.57 | 189.76 | 8.97 | 195.61 | 4.77 |
| 80 | 1.130 | 204.67 | 107.59 | 204.80 | 82.65 | 215.74 | 52.62 | 213.83 | 44.47 | 192.20 | 19.66 | 184.95 | 19.28 | 196.02 | 7.19 | 201.75 | 4.39 |
| 81 | 1.144 | 206.27 | 107.46 | 206.78 | 82.52 | 218.49 | 53.13 | 216.96 | 44.47 | 197.36 | 17.88 | 190.11 | 16.73 | 202.45 | 6.81 | 208.94 | 3.75 |
| 82 | 1.158 | 208.30 | 107.72 | 209.07 | 83.03 | 221.28 | 53.89 | 219.88 | 45.24 | 202.96 | 16.86 | 195.58 | 14.57 | 209.19 | 5.41 | 215.94 | 4.26 |
| 83 | 1.173 | 210.18 | 107.72 | 211.07 | 83.03 | 223.80 | 54.02 | 222.91 | 45.24 | 208.15 | 15.59 | 201.27 | 12.53 | 215.14 | 4.90 | 222.65 | 3.50 |
| 84 | 1.187 | 211.95 | 107.46 | 212.97 | 82.78 | 226.20 | 54.40 | 225.70 | 45.49 | 213.86 | 13.68 | 207.37 | 10.12 | 221.88 | 4.39 | 229.13 | 3.88 |
| 85 | 1.201 | 213.83 | 107.21 | 215.10 | 82.90 | 228.59 | 54.65 | 228.21 | 45.49 | 219.43 | 12.79 | 213.45 | 8.59 | 228.72 | 3.75 | 235.59 | 4.90 |
| 86 | 1.215 | 215.63 | 107.08 | 217.03 | 82.65 | 230.52 | 54.65 | 230.52 | 45.11 | 224.92 | 11.39 | 219.32 | 6.68 | 234.84 | 4.26 | 241.72 | 5.28 |

*(continued)*

**TABLE A.1** *(Continued)*

| FRAME | TIME S | BASE RIB X | CAGE Y | RIGHT X | HIP Y | RIGHT X | KNEE Y | RIGHT X | FIBULA Y | RIGHT X | ANKLE Y | RIGHT X | HEEL Y | RIGHT X | METAT. Y | RIGHT X | TOE Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 87 | 1.230 | 217.58 | 106.70 | 219.11 | 82.65 | 232.85 | 54.65 | 232.60 | 45.24 | 230.94 | 11.39 | 225.85 | 5.66 | 241.38 | 4.52 | 247.74 | 6.30 |
| 88 | 1.244 | 219.36 | 106.45 | 220.89 | 82.27 | 234.63 | 53.64 | 234.76 | 44.47 | 236.28 | 11.01 | 232.09 | 4.52 | 247.86 | 4.52 | 254.10 | 7.32 |
| 89 | 1.258 | 221.06 | 105.94 | 222.71 | 81.63 | 236.07 | 53.13 | 236.84 | 44.35 | 241.80 | 10.37 | 237.35 | 4.01 | 253.00 | 6.05 | 259.36 | 9.48 |
| 90 | 1.273 | 223.53 | 105.55 | 225.18 | 81.12 | 238.29 | 52.75 | 239.18 | 43.46 | 247.07 | 10.63 | 243.89 | 3.63 | 259.41 | 7.06 | 265.01 | 11.26 |
| 91 | 1.287 | 225.31 | 104.92 | 227.60 | 81.00 | 239.81 | 51.73 | 241.47 | 43.33 | 252.03 | 11.01 | 249.23 | 3.63 | 264.24 | 8.84 | 269.33 | 12.92 |
| 92 | 1.301 | 227.33 | 104.66 | 229.75 | 80.10 | 241.33 | 50.84 | 243.36 | 42.82 | 255.83 | 11.01 | 253.54 | 3.63 | 268.31 | 9.86 | 273.40 | 14.32 |
| 93 | 1.316 | 229.28 | 104.41 | 231.57 | 79.98 | 243.03 | 50.46 | 245.32 | 42.82 | 259.31 | 11.26 | 257.53 | 4.14 | 271.78 | 10.75 | 276.49 | 15.84 |
| 94 | 1.330 | 231.49 | 104.03 | 234.16 | 79.60 | 245.23 | 50.33 | 247.40 | 42.82 | 262.03 | 12.15 | 260.50 | 4.01 | 274.75 | 11.26 | 278.95 | 16.48 |
| 95 | 1.344 | 233.80 | 103.52 | 236.47 | 79.21 | 247.67 | 49.82 | 249.57 | 42.31 | 263.95 | 10.88 | 262.55 | 3.63 | 276.42 | 10.88 | 281.39 | 15.72 |
| 96 | 1.358 | 235.62 | 103.01 | 238.80 | 78.83 | 250.00 | 49.82 | 251.91 | 41.68 | 265.27 | 10.24 | 263.49 | 3.12 | 277.74 | 9.99 | 282.70 | 14.70 |
| 97 | 1.373 | 238.04 | 103.01 | 241.60 | 79.21 | 252.80 | 50.33 | 254.32 | 42.06 | 266.41 | 9.86 | 264.12 | 2.99 | 278.63 | 8.59 | 283.72 | 13.43 |
| 98 | 1.387 | 240.34 | 103.14 | 244.29 | 79.21 | 255.23 | 50.20 | 256.50 | 41.55 | 267.06 | 9.23 | 264.14 | 3.37 | 279.15 | 7.44 | 284.50 | 11.39 |
| 99 | 1.401 | 242.88 | 103.01 | 246.83 | 79.09 | 257.39 | 50.07 | 258.92 | 41.42 | 268.72 | 9.48 | 264.52 | 3.63 | 280.42 | 6.05 | 286.15 | 9.10 |
| 100 | 1.416 | 245.09 | 102.63 | 249.16 | 79.34 | 259.60 | 50.07 | 260.74 | 41.68 | 269.78 | 9.23 | 264.69 | 3.63 | 281.10 | 4.90 | 287.08 | 7.95 |
| 101 | 1.430 | 247.53 | 103.26 | 251.60 | 79.72 | 261.90 | 50.96 | 263.30 | 42.57 | 270.18 | 9.48 | 265.21 | 4.26 | 281.25 | 4.39 | 287.86 | 6.68 |
| 102 | 1.444 | 249.91 | 102.88 | 253.73 | 80.36 | 264.42 | 50.96 | 265.95 | 42.44 | 270.78 | 9.10 | 265.18 | 3.63 | 281.47 | 3.50 | 288.09 | 5.54 |
| 103 | 1.459 | 251.81 | 103.39 | 255.63 | 81.00 | 266.70 | 51.60 | 267.59 | 42.82 | 271.15 | 9.23 | 265.30 | 4.39 | 281.84 | 3.63 | 288.20 | 5.15 |
| 104 | 1.473 | 253.96 | 104.16 | 257.65 | 81.38 | 268.47 | 51.47 | 269.23 | 42.69 | 271.40 | 9.23 | 265.16 | 3.88 | 281.96 | 3.25 | 288.45 | 5.03 |
| 105 | 1.487 | 256.07 | 104.28 | 259.51 | 81.25 | 269.56 | 51.35 | 270.19 | 42.31 | 271.34 | 8.59 | 265.36 | 3.50 | 281.52 | 2.74 | 288.14 | 4.39 |
| 106 | 1.501 | 257.61 | 105.05 | 260.92 | 81.63 | 270.34 | 51.60 | 270.85 | 42.44 | 270.85 | 8.84 | 264.99 | 3.88 | 281.15 | 2.35 | 287.77 | 4.52 |

**TABLE A.2(*a*) Filtered Marker Kinematics—Rib Cage and Greater Trochanter (Hip)**

| | | | BASE RIB CAGE | | | | | | RIGHT HIP | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| TOR | 1 | 0.000 | 0.4695 | 1.43 | 0.3 | 1.0435 | 0.22 | 1.0 | 0.4474 | 1.64 | −2.2 | 0.7870 | 0.01 | 3.3 |
| | 2 | 0.014 | 0.4900 | 1.41 | −1.6 | 1.0467 | 0.23 | 0.5 | 0.4706 | 1.59 | −4.6 | 0.7875 | 0.07 | 4.3 |
| | 3 | 0.029 | 0.5100 | 1.38 | −2.9 | 1.0501 | 0.24 | 0.4 | 0.4928 | 1.51 | −5.6 | 0.7889 | 0.14 | 4.8 |
| | 4 | 0.043 | 0.5294 | 1.33 | −3.4 | 1.0535 | 0.24 | 0.6 | 0.5138 | 1.43 | −5.3 | 0.7914 | 0.21 | 4.7 |
| | 5 | 0.057 | 0.5481 | 1.28 | −3.3 | 1.0570 | 0.25 | 0.6 | 0.5336 | 1.36 | −3.9 | 0.7948 | 0.27 | 3.9 |
| | 6 | 0.072 | 0.5661 | 1.24 | −2.5 | 1.0607 | 0.26 | 0.2 | 0.5526 | 1.31 | −2.0 | 0.7991 | 0.32 | 2.6 |
| | 7 | 0.086 | 0.5836 | 1.21 | −1.5 | 1.0644 | 0.26 | −0.7 | 0.5712 | 1.30 | −0.2 | 0.8039 | 0.34 | 1.2 |
| | 8 | 0.100 | 0.6007 | 1.20 | −0.5 | 1.0680 | 0.24 | −1.8 | 0.5898 | 1.31 | 1.0 | 0.8089 | 0.35 | −0.2 |
| | 9 | 0.114 | 0.6178 | 1.20 | 0.2 | 1.0713 | 0.21 | −2.8 | 0.6086 | 1.33 | 1.7 | 0.8139 | 0.34 | −1.5 |
| | 10 | 0.129 | 0.6349 | 1.20 | 0.5 | 1.0739 | 0.16 | −3.5 | 0.6278 | 1.36 | 1.9 | 0.8185 | 0.31 | −2.8 |
| | 11 | 0.143 | 0.6521 | 1.21 | 0.5 | 1.0759 | 0.11 | −3.7 | 0.6474 | 1.38 | 1.9 | 0.8226 | 0.26 | −3.8 |
| | 12 | 0.157 | 0.6695 | 1.22 | 0.5 | 1.0770 | 0.05 | −3.4 | 0.6673 | 1.41 | 1.6 | 0.8259 | 0.20 | −4.4 |
| | 13 | 0.172 | 0.6869 | 1.22 | 0.5 | 1.0774 | 0.01 | −2.7 | 0.6876 | 1.43 | 1.1 | 0.8283 | 0.13 | −4.6 |
| | 14 | 0.186 | 0.7044 | 1.23 | 0.6 | 1.0773 | −0.02 | −2.1 | 0.7082 | 1.44 | 0.5 | 0.8298 | 0.07 | −4.7 |
| | 15 | 0.200 | 0.7221 | 1.24 | 1.0 | 1.0767 | −0.05 | −1.9 | 0.7288 | 1.44 | 0.2 | 0.8302 | 0.00 | −4.7 |
| | 16 | 0.215 | 0.7400 | 1.26 | 1.6 | 1.0758 | −0.08 | −2.1 | 0.7495 | 1.45 | 0.3 | 0.8298 | −0.07 | −4.6 |
| | 17 | 0.229 | 0.7581 | 1.29 | 2.2 | 1.0745 | −0.11 | −2.3 | 0.7702 | 1.45 | 0.7 | 0.8283 | −0.13 | −4.4 |
| | 18 | 0.243 | 0.7768 | 1.32 | 2.8 | 1.0727 | −0.14 | −2.5 | 0.7910 | 1.47 | 1.1 | 0.8260 | −0.19 | −4.0 |
| | 19 | 0.257 | 0.7960 | 1.37 | 3.0 | 1.0704 | −0.18 | −2.8 | 0.8121 | 1.48 | 1.4 | 0.8228 | −0.25 | −3.1 |
| | 20 | 0.272 | 0.8158 | 1.41 | 2.9 | 1.0675 | −0.22 | −2.8 | 0.8335 | 1.51 | 1.7 | 0.8189 | −0.28 | −1.7 |
| | 21 | 0.286 | 0.8363 | 1.45 | 2.5 | 1.0640 | −0.26 | −2.4 | 0.8552 | 1.53 | 1.8 | 0.8147 | −0.30 | 0.1 |

*(continued)*

**TABLE A.2(*a*)** ***(Continued)***

| | FRAME | TIME S | BASE RIB CAGE X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | RIGHT HIP X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 22 | 0.300 | 0.8573 | 1.48 | 2.0 | 1.0600 | −0.29 | −1.6 | 0.8773 | 1.56 | 1.9 | 0.8105 | −0.28 | 1.6 |
| | 23 | 0.315 | 0.8787 | 1.51 | 1.4 | 1.0557 | −0.31 | −0.7 | 0.8997 | 1.59 | 2.1 | 0.8067 | −0.25 | 2.3 |
| | 24 | 0.329 | 0.9003 | 1.52 | 1.1 | 1.0512 | −0.31 | 0.3 | 0.9226 | 1.62 | 2.2 | 0.8033 | −0.21 | 2.6 |
| | 25 | 0.343 | 0.9222 | 1.54 | 1.3 | 1.0468 | −0.30 | 1.7 | 0.9460 | 1.65 | 2.1 | 0.8005 | −0.18 | 2.8 |
| | 26 | 0.357 | 0.9443 | 1.56 | 1.6 | 1.0427 | −0.26 | 3.2 | 0.9698 | 1.68 | 1.6 | 0.7983 | −0.13 | 3.1 |
| | 27 | 0.372 | 0.9668 | 1.58 | 1.8 | 1.0392 | −0.21 | 4.4 | 0.9940 | 1.69 | 0.8 | 0.7967 | −0.09 | 3.7 |
| HCR | 28 | 0.386 | 0.9896 | 1.61 | 1.5 | 1.0367 | −0.14 | 5.0 | 1.0183 | 1.70 | −0.4 | 0.7959 | −0.03 | 4.4 |
| | 29 | 0.400 | 1.0128 | 1.63 | 0.9 | 1.0353 | −0.06 | 4.9 | 1.0425 | 1.68 | −1.7 | 0.7959 | 0.04 | 4.9 |
| | 30 | 0.415 | 1.0362 | 1.64 | 0.0 | 1.0349 | 0.00 | 4.3 | 1.0664 | 1.65 | −3.0 | 0.7970 | 0.11 | 5.0 |
| | 31 | 0.429 | 1.0596 | 1.63 | −0.9 | 1.0353 | 0.06 | 3.7 | 1.0897 | 1.60 | −4.0 | 0.7991 | 0.18 | 4.5 |
| | 32 | 0.443 | 1.0828 | 1.61 | −1.8 | 1.0366 | 0.11 | 3.2 | 1.1121 | 1.53 | −4.7 | 0.8023 | 0.24 | 3.1 |
| | 33 | 0.458 | 1.1056 | 1.58 | −2.5 | 1.0384 | 0.15 | 2.9 | 1.1336 | 1.46 | −4.7 | 0.8060 | 0.27 | 1.1 |
| | 34 | 0.472 | 1.1279 | 1.54 | −2.8 | 1.0408 | 0.19 | 2.7 | 1.1540 | 1.40 | −3.8 | 0.8100 | 0.27 | −0.6 |
| | 35 | 0.486 | 1.1496 | 1.50 | −2.6 | 1.0438 | 0.23 | 2.3 | 1.1736 | 1.36 | −2.3 | 0.8139 | 0.25 | −1.5 |
| | 36 | 0.500 | 1.1707 | 1.46 | −2.2 | 1.0473 | 0.26 | 1.8 | 1.1928 | 1.34 | −1.0 | 0.8173 | 0.23 | −1.4 |
| | 37 | 0.515 | 1.1915 | 1.43 | −2.0 | 1.0512 | 0.28 | 1.0 | 1.2118 | 1.33 | −0.8 | 0.8205 | 0.21 | −1.3 |
| | 38 | 0.529 | 1.2118 | 1.41 | −2.1 | 1.0552 | 0.29 | 0.3 | 1.2307 | 1.31 | −1.4 | 0.8234 | 0.19 | −1.6 |
| | 39 | 0.543 | 1.2317 | 1.38 | −2.1 | 1.0594 | 0.29 | −0.2 | 1.2494 | 1.29 | −2.4 | 0.8260 | 0.17 | −2.0 |
| | 40 | 0.558 | 1.2511 | 1.35 | −1.8 | 1.0634 | 0.28 | −0.7 | 1.2675 | 1.25 | −3.2 | 0.8282 | 0.14 | −2.0 |
| | 41 | 0.572 | 1.2702 | 1.32 | −1.3 | 1.0673 | 0.27 | −1.1 | 1.2850 | 1.20 | −3.6 | 0.8300 | 0.11 | −1.7 |
| | 42 | 0.586 | 1.2890 | 1.31 | −0.7 | 1.0710 | 0.25 | −1.6 | 1.3018 | 1.14 | −3.3 | 0.8314 | 0.09 | −1.6 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 0.601 | 1.3076 | 1.30 | −0.2 | 1.0744 | 0.22 | −2.4 | 1.3178 | 1.10 | −2.6 | 0.8325 | 0.07 | −1.9 |
| 44 | 0.615 | 1.3263 | 1.30 | 0.3 | 1.0773 | 0.18 | −3.2 | 1.3332 | 1.07 | −1.7 | 0.8333 | 0.03 | −2.7 |
| 45 | 0.629 | 1.3450 | 1.31 | 0.7 | 1.0796 | 0.13 | −4.0 | 1.3484 | 1.05 | −0.9 | 0.8335 | −0.01 | −3.3 |
| 46 | 0.643 | 1.3638 | 1.33 | 1.0 | 1.0810 | 0.07 | −4.6 | 1.3633 | 1.04 | −0.3 | 0.8330 | −0.06 | −3.3 |
| 47 | 0.658 | 1.3829 | 1.34 | 1.1 | 1.0815 | 0.00 | −5.0 | 1.3782 | 1.04 | 0.3 | 0.8318 | −0.11 | −2.6 |
| 48 | 0.672 | 1.4021 | 1.36 | 1.1 | 1.0809 | −0.08 | −4.8 | 1.3931 | 1.05 | 1.1 | 0.8300 | −0.14 | −1.8 |
| 49 | 0.686 | 1.4217 | 1.37 | 1.1 | 1.0793 | −0.14 | −4.0 | 1.4083 | 1.07 | 1.9 | 0.8279 | −0.16 | −1.2 |
| 50 | 0.701 | 1.4414 | 1.39 | 0.9 | 1.0769 | −0.19 | −3.0 | 1.4239 | 1.11 | 2.2 | 0.8255 | −0.17 | −0.8 |
| 51 | 0.715 | 1.4614 | 1.40 | 0.6 | 1.0739 | −0.23 | −2.3 | 1.4400 | 1.14 | 1.8 | 0.8230 | −0.18 | −0.5 |
| 52 | 0.729 | 1.4814 | 1.40 | 0.4 | 1.0704 | −0.26 | −1.9 | 1.4564 | 1.16 | 1.2 | 0.8204 | −0.18 | −0.2 |
| 53 | 0.744 | 1.5015 | 1.41 | 0.5 | 1.0666 | −0.28 | −1.3 | 1.4731 | 1.17 | 1.1 | 0.8178 | −0.18 | 0.2 |
| 54 | 0.758 | 1.5217 | 1.42 | 0.8 | 1.0624 | −0.29 | −0.5 | 1.4900 | 1.19 | 1.4 | 0.8151 | −0.18 | 0.5 |
| 55 | 0.772 | 1.5421 | 1.43 | 0.9 | 1.0582 | −0.29 | 0.5 | 1.5071 | 1.21 | 1.8 | 0.8127 | −0.17 | 0.6 |
| 56 | 0.786 | 1.5626 | 1.44 | 0.7 | 1.0541 | −0.28 | 1.3 | 1.5247 | 1.24 | 1.9 | 0.8103 | −0.16 | 0.5 |
| 57 | 0.801 | 1.5833 | 1.45 | 0.5 | 1.0503 | −0.25 | 1.9 | 1.5426 | 1.27 | 2.3 | 0.8081 | −0.15 | 0.4 |
| 58 | 0.815 | 1.6041 | 1.46 | 0.7 | 1.0468 | −0.22 | 2.1 | 1.5610 | 1.31 | 3.1 | 0.8059 | −0.15 | 0.4 |
| 59 | 0.829 | 1.6250 | 1.47 | 1.5 | 1.0439 | −0.19 | 2.1 | 1.5800 | 1.36 | 4.5 | 0.8038 | −0.14 | 0.3 |
| 60 | 0.844 | 1.6461 | 1.50 | 2.6 | 1.0413 | −0.16 | 1.9 | 1.5999 | 1.44 | 6.0 | 0.8018 | −0.14 | 0.0 |
| 61 | 0.858 | 1.6678 | 1.54 | 3.6 | 1.0392 | −0.14 | 1.5 | 1.6210 | 1.53 | 7.2 | 0.7998 | −0.14 | −0.3 |
| 62 | 0.872 | 1.6903 | 1.60 | 4.0 | 1.0373 | −0.12 | 1.2 | 1.6436 | 1.64 | 7.7 | 0.7977 | −0.15 | −0.3 |
| 63 | 0.887 | 1.7136 | 1.66 | 3.6 | 1.0357 | −0.10 | 1.5 | 1.6679 | 1.75 | 7.3 | 0.7955 | −0.15 | −0.1 |
| 64 | 0.901 | 1.7377 | 1.70 | 1.8 | 1.0343 | −0.08 | 2.3 | 1.6937 | 1.85 | 5.5 | 0.7933 | −0.15 | 0.2 |
| 65 | 0.915 | 1.7623 | 1.71 | −1.0 | 1.0334 | −0.04 | 3.2 | 1.7208 | 1.91 | 2.5 | 0.7911 | −0.15 | 0.7 |
| 66 | 0.929 | 1.7866 | 1.67 | −4.0 | 1.0332 | 0.01 | 4.0 | 1.7483 | 1.92 | −1.1 | 0.7891 | −0.13 | 1.3 |
| 67 | 0.944 | 1.8101 | 1.60 | −6.0 | 1.0338 | 0.07 | 4.3 | 1.7756 | 1.88 | −4.2 | 0.7873 | −0.11 | 2.0 |
| 68 | 0.958 | 1.8323 | 1.50 | −6.4 | 1.0353 | 0.14 | 4.2 | 1.8020 | 1.80 | −6.4 | 0.7859 | −0.08 | 2.9 |
| 69 | 0.972 | 1.8531 | 1.41 | −5.8 | 1.0377 | 0.19 | 3.8 | 1.8270 | 1.69 | −7.5 | 0.7851 | −0.03 | 3.8 |

*(continued)*

**TABLE A.2(*a*)** ***(Continued)***

| | | | BASE RIB CAGE | | | | | | RIGHT HIP | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| TOR | 70 | 0.987 | 1.8727 | 1.34 | −4.7 | 1.0409 | 0.24 | 3.0 | 1.8505 | 1.58 | −7.7 | 0.7851 | 0.03 | 4.5 |
| | 71 | 1.001 | 1.8914 | 1.28 | −3.5 | 1.0447 | 0.28 | 1.8 | 1.8723 | 1.48 | −6.8 | 0.7861 | 0.10 | 4.8 |
| | 72 | 1.015 | 1.9093 | 1.24 | −2.4 | 1.0489 | 0.30 | 0.4 | 1.8927 | 1.39 | −5.0 | 0.7880 | 0.17 | 4.6 |
| | 73 | 1.030 | 1.9268 | 1.21 | −1.4 | 1.0532 | 0.29 | −0.8 | 1.9120 | 1.33 | −3.0 | 0.7909 | 0.23 | 4.1 |
| | 74 | 1.044 | 1.9440 | 1.20 | −0.7 | 1.0572 | 0.27 | −1.3 | 1.9308 | 1.30 | −1.1 | 0.7947 | 0.29 | 3.5 |
| | 75 | 1.058 | 1.9610 | 1.19 | −0.3 | 1.0610 | 0.26 | −1.1 | 1.9493 | 1.30 | 0.5 | 0.7991 | 0.33 | 2.8 |
| | 76 | 1.072 | 1.9780 | 1.19 | 0.1 | 1.0645 | 0.24 | −1.1 | 1.9680 | 1.32 | 1.7 | 0.8042 | 0.37 | 1.5 |
| | 77 | 1.087 | 1.9951 | 1.19 | 0.4 | 1.0679 | 0.22 | −1.6 | 1.9870 | 1.35 | 2.4 | 0.8096 | 0.38 | −0.4 |
| | 78 | 1.101 | 2.0122 | 1.20 | 0.7 | 1.0710 | 0.19 | −2.6 | 2.0066 | 1.39 | 2.5 | 0.8149 | 0.36 | −2.3 |
| | 79 | 1.115 | 2.0294 | 1.21 | 1.0 | 1.0735 | 0.15 | −3.4 | 2.0267 | 1.42 | 2.0 | 0.8198 | 0.31 | −3.9 |
| | 80 | 1.130 | 2.0469 | 1.23 | 1.3 | 1.0753 | 0.10 | −3.7 | 2.0473 | 1.45 | 1.1 | 0.8238 | 0.24 | −4.8 |
| | 81 | 1.144 | 2.0647 | 1.25 | 1.3 | 1.0763 | 0.04 | −3.8 | 2.0681 | 1.45 | 0.1 | 0.8268 | 0.17 | −5.0 |
| | 82 | 1.158 | 2.0827 | 1.27 | 1.0 | 1.0765 | −0.01 | −3.7 | 2.0889 | 1.45 | −0.8 | 0.8287 | 0.10 | −4.9 |
| | 83 | 1.173 | 2.1009 | 1.28 | 0.7 | 1.0760 | −0.06 | −3.6 | 2.1095 | 1.43 | −1.1 | 0.8297 | 0.03 | −4.7 |
| | 84 | 1.187 | 2.1193 | 1.29 | 0.5 | 1.0748 | −0.11 | −3.4 | 2.1298 | 1.42 | −1.1 | 0.8296 | −0.03 | −4.4 |
| | 85 | 1.201 | 2.1378 | 1.30 | 0.6 | 1.0728 | −0.16 | −3.0 | 2.1500 | 1.40 | −0.7 | 0.8287 | −0.09 | −4.2 |
| | 86 | 1.215 | 2.1563 | 1.30 | 0.8 | 1.0702 | −0.20 | −2.7 | 2.1699 | 1.40 | 0.1 | 0.8270 | −0.15 | −4.1 |
| | 87 | 1.230 | 2.1751 | 1.32 | 1.1 | 1.0671 | −0.24 | −2.3 | 2.1899 | 1.40 | 1.0 | 0.8244 | −0.21 | −3.8 |
| | 88 | 1.244 | 2.1940 | 1.34 | 1.5 | 1.0635 | −0.27 | −1.8 | 2.2100 | 1.43 | 2.0 | 0.8210 | −0.26 | −3.1 |
| | 89 | 1.258 | 2.2133 | 1.36 | 1.6 | 1.0595 | −0.29 | −1.1 | 2.2306 | 1.46 | 2.6 | 0.8169 | −0.30 | −2.0 |
| | 90 | 1.273 | 2.2329 | 1.38 | 1.6 | 1.0552 | −0.30 | −0.3 | 2.2518 | 1.50 | 2.6 | 0.8124 | −0.32 | −0.7 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 91 | 1.287 | 2.2529 | 1.41 | 1.7 | 1.0510 | −0.30 | 0.4 | 2.2735 | 1.54 | 2.6 | 0.8078 | −0.32 | 0.6 |
| | 92 | 1.301 | 2.2731 | 1.43 | 1.9 | 1.0468 | −0.29 | 0.8 | 2.2957 | 1.57 | 2.8 | 0.8033 | −0.30 | 1.8 |
| | 93 | 1.316 | 2.2938 | 1.46 | 2.2 | 1.0428 | −0.27 | 1.3 | 2.3185 | 1.62 | 3.3 | 0.7992 | −0.27 | 3.0 |
| | 94 | 1.330 | 2.3149 | 1.49 | 2.4 | 1.0390 | −0.25 | 1.9 | 2.3419 | 1.67 | 3.5 | 0.7957 | −0.22 | 4.0 |
| | 95 | 1.344 | 2.3365 | 1.53 | 2.6 | 1.0356 | −0.22 | 2.8 | 2.3661 | 1.72 | 3.1 | 0.7930 | −0.15 | 4.8 |
| | 96 | 1.358 | 2.3587 | 1.57 | 2.6 | 1.0328 | −0.17 | 3.5 | 2.3910 | 1.75 | 2.0 | 0.7913 | −0.08 | 5.3 |
| HCR | 97 | 1.373 | 2.3813 | 1.60 | 2.2 | 1.0307 | −0.12 | 3.7 | 2.4163 | 1.77 | 0.2 | 0.7908 | 0.00 | 5.3 |
| | 98 | 1.387 | 2.4045 | 1.63 | 1.3 | 1.0294 | −0.06 | 3.9 | 2.4417 | 1.76 | −1.7 | 0.7913 | 0.07 | 5.2 |
| | 99 | 1.401 | 2.4279 | 1.64 | 0.1 | 1.0289 | −0.01 | 4.1 | 2.4667 | 1.72 | −3.5 | 0.7929 | 0.15 | 4.8 |
| | 100 | 1.416 | 2.4514 | 1.63 | −1.1 | 1.0292 | 0.05 | 4.5 | 2.4909 | 1.66 | −4.7 | 0.7955 | 0.21 | 4.0 |
| | 101 | 1.430 | 2.4746 | 1.61 | −2.3 | 1.0304 | 0.12 | 4.7 | 2.5142 | 1.59 | −5.2 | 0.7989 | 0.26 | 2.4 |
| | 102 | 1.444 | 2.4974 | 1.57 | −3.2 | 1.0327 | 0.19 | 4.4 | 2.5364 | 1.51 | −5.3 | 0.8029 | 0.28 | 0.6 |
| | 103 | 1.459 | 2.5194 | 1.52 | −4.0 | 1.0358 | 0.25 | 3.5 | 2.5575 | 1.44 | −5.2 | 0.8069 | 0.28 | −1.0 |
| | 104 | 1.473 | 2.5407 | 1.45 | −4.9 | 1.0398 | 0.29 | 2.1 | 2.5775 | 1.36 | −5.2 | 0.8108 | 0.25 | −1.8 |
| | 105 | 1.487 | 2.5610 | 1.37 | −6.4 | 1.0441 | 0.31 | 0.4 | 2.5965 | 1.29 | −6.0 | 0.8142 | 0.22 | −2.0 |
| | 106 | 1.501 | 2.5800 | 1.27 | −8.6 | 1.0485 | 0.30 | −1.1 | 2.6143 | 1.19 | −7.9 | 0.8171 | 0.19 | −2.1 |

**TABLE A.2(*b*) Filtered Marker Kinematics—Femoral Lateral Epicondyle (Knee) and Head of Fibula**

| | | | RIGHT KNEE | | | | | | RIGHT FIBULA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| TOR | 1 | 0.000 | 0.4075 | 2.66 | 6.0 | 0.4754 | −0.13 | 5.9 | 0.3570 | 2.84 | 8.4 | 0.4052 | −0.16 | 5.1 |
| | 2 | 0.014 | 0.4461 | 2.71 | 1.6 | 0.4741 | −0.03 | 8.3 | 0.3985 | 2.93 | 3.7 | 0.4036 | −0.07 | 7.1 |
| | 3 | 0.029 | 0.4850 | 2.71 | −1.5 | 0.4746 | 0.10 | 9.5 | 0.4407 | 2.95 | 0.0 | 0.4034 | 0.05 | 8.2 |
| | 4 | 0.043 | 0.5235 | 2.67 | −3.5 | 0.4771 | 0.24 | 9.4 | 0.4829 | 2.93 | −2.8 | 0.4049 | 0.17 | 8.2 |
| | 5 | 0.057 | 0.5613 | 2.61 | −4.8 | 0.4815 | 0.37 | 8.2 | 0.5244 | 2.87 | −4.8 | 0.4082 | 0.28 | 7.1 |
| | 6 | 0.072 | 0.5980 | 2.53 | −5.8 | 0.4877 | 0.48 | 6.1 | 0.5649 | 2.79 | −5.9 | 0.4130 | 0.37 | 5.4 |
| | 7 | 0.086 | 0.6336 | 2.44 | −6.5 | 0.4952 | 0.55 | 3.6 | 0.6041 | 2.70 | −6.7 | 0.4189 | 0.44 | 3.4 |
| | 8 | 0.100 | 0.6678 | 2.34 | −7.0 | 0.5034 | 0.58 | 1.2 | 0.6420 | 2.60 | −7.2 | 0.4255 | 0.47 | 1.4 |
| | 9 | 0.114 | 0.7006 | 2.24 | −7.4 | 0.5118 | 0.58 | −0.7 | 0.6784 | 2.49 | −7.7 | 0.4324 | 0.48 | −0.7 |
| | 10 | 0.129 | 0.7319 | 2.13 | −7.8 | 0.5200 | 0.56 | −2.4 | 0.7133 | 2.38 | −8.1 | 0.4391 | 0.45 | −2.5 |
| | 11 | 0.143 | 0.7615 | 2.02 | −8.0 | 0.5278 | 0.51 | −4.1 | 0.7464 | 2.26 | −8.3 | 0.4453 | 0.40 | −4.1 |
| | 12 | 0.157 | 0.7896 | 1.90 | −7.9 | 0.5347 | 0.44 | −5.7 | 0.7779 | 2.14 | −8.4 | 0.4506 | 0.34 | −5.1 |
| | 13 | 0.172 | 0.8159 | 1.79 | −7.6 | 0.5404 | 0.35 | −7.0 | 0.8076 | 2.02 | −8.3 | 0.4549 | 0.26 | −5.7 |
| | 14 | 0.186 | 0.8407 | 1.68 | −7.2 | 0.5447 | 0.24 | −7.8 | 0.8357 | 1.90 | −8.1 | 0.4580 | 0.17 | −6.0 |
| | 15 | 0.200 | 0.8641 | 1.58 | −6.7 | 0.5474 | 0.13 | −8.3 | 0.8620 | 1.79 | −7.9 | 0.4598 | 0.08 | −6.1 |
| | 16 | 0.215 | 0.8860 | 1.49 | −6.2 | 0.5483 | 0.01 | −8.3 | 0.8868 | 1.68 | −7.4 | 0.4604 | 0.00 | −5.9 |
| | 17 | 0.229 | 0.9067 | 1.41 | −5.6 | 0.5476 | −0.11 | −8.0 | 0.9100 | 1.57 | −6.5 | 0.4597 | −0.09 | −5.6 |
| | 18 | 0.243 | 0.9263 | 1.33 | −4.7 | 0.5451 | −0.22 | −7.1 | 0.9318 | 1.49 | −5.1 | 0.4579 | −0.16 | −5.0 |
| | 19 | 0.257 | 0.9448 | 1.27 | −3.2 | 0.5412 | −0.31 | −5.6 | 0.9526 | 1.43 | −3.3 | 0.4551 | −0.23 | −3.9 |
| | 20 | 0.272 | 0.9627 | 1.24 | −1.2 | 0.5361 | −0.38 | −3.6 | 0.9727 | 1.40 | −1.4 | 0.4514 | −0.27 | −2.4 |
| | 21 | 0.286 | 0.9803 | 1.24 | 0.9 | 0.5303 | −0.42 | −0.9 | 0.9925 | 1.39 | 0.2 | 0.4472 | −0.30 | −0.6 |
| | 22 | 0.300 | 0.9981 | 1.27 | 2.8 | 0.5242 | −0.41 | 1.8 | 1.0124 | 1.40 | 1.2 | 0.4430 | −0.29 | 0.6 |
| | 23 | 0.315 | 1.0165 | 1.32 | 4.2 | 0.5186 | −0.36 | 3.8 | 1.0326 | 1.42 | 1.7 | 0.4389 | −0.28 | 1.1 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24 | 0.329 | 1.0358 | 1.39 | 5.0 | 0.5138 | −0.30 | 4.7 | 1.0531 | 1.45 | 1.8 | 0.4350 | −0.26 | 1.0 |
| | 25 | 0.343 | 1.0561 | 1.46 | 4.8 | 0.5100 | −0.23 | 4.7 | 1.0741 | 1.48 | 1.6 | 0.4314 | −0.25 | 1.0 |
| | 26 | 0.357 | 1.0776 | 1.52 | 3.7 | 0.5072 | −0.17 | 4.4 | 1.0953 | 1.50 | 1.0 | 0.4279 | −0.23 | 1.5 |
| | 27 | 0.372 | 1.0997 | 1.57 | 1.8 | 0.5053 | −0.10 | 4.2 | 1.1169 | 1.51 | 0.2 | 0.4247 | −0.21 | 2.6 |
| HCR | 28 | 0.386 | 1.1223 | 1.58 | −0.2 | 0.5042 | −0.05 | 4.1 | 1.1384 | 1.50 | −0.8 | 0.4220 | −0.16 | 4.0 |
| | 29 | 0.400 | 1.1448 | 1.56 | −1.6 | 0.5039 | 0.01 | 4.2 | 1.1598 | 1.48 | −1.5 | 0.4202 | −0.09 | 4.9 |
| | 30 | 0.415 | 1.1669 | 1.53 | −2.1 | 0.5046 | 0.07 | 4.1 | 1.1808 | 1.46 | −1.9 | 0.4194 | −0.02 | 4.8 |
| | 31 | 0.429 | 1.1885 | 1.50 | −2.3 | 0.5061 | 0.13 | 3.5 | 1.2015 | 1.43 | −2.6 | 0.4196 | 0.05 | 3.7 |
| | 32 | 0.443 | 1.2097 | 1.46 | −3.2 | 0.5083 | 0.17 | 2.0 | 1.2216 | 1.38 | −4.0 | 0.4207 | 0.09 | 1.9 |
| | 33 | 0.458 | 1.2304 | 1.41 | −5.3 | 0.5110 | 0.19 | −0.1 | 1.2410 | 1.31 | −6.2 | 0.4221 | 0.10 | 0.1 |
| | 34 | 0.472 | 1.2500 | 1.31 | −7.7 | 0.5138 | 0.17 | −2.1 | 1.2592 | 1.21 | −8.5 | 0.4235 | 0.09 | −1.1 |
| | 35 | 0.486 | 1.2679 | 1.19 | −9.5 | 0.5160 | 0.13 | −3.3 | 1.2755 | 1.07 | −9.9 | 0.4247 | 0.07 | −1.7 |
| | 36 | 0.500 | 1.2839 | 1.04 | −9.8 | 0.5175 | 0.08 | −3.5 | 1.2898 | 0.92 | −10.4 | 0.4255 | 0.04 | −1.6 |
| | 37 | 0.515 | 1.2977 | 0.90 | −9.3 | 0.5182 | 0.03 | −2.9 | 1.3019 | 0.77 | −10.4 | 0.4260 | 0.02 | −1.0 |
| | 38 | 0.529 | 1.3097 | 0.78 | −8.2 | 0.5183 | −0.01 | −2.0 | 1.3119 | 0.63 | −9.8 | 0.4262 | 0.02 | −0.1 |
| | 39 | 0.543 | 1.3200 | 0.67 | −7.0 | 0.5180 | −0.03 | −0.9 | 1.3198 | 0.49 | −8.3 | 0.4265 | 0.02 | 0.6 |
| | 40 | 0.558 | 1.3288 | 0.58 | −5.4 | 0.5175 | −0.03 | 0.3 | 1.3260 | 0.39 | −6.0 | 0.4269 | 0.03 | 0.8 |
| | 41 | 0.572 | 1.3365 | 0.51 | −3.4 | 0.5171 | −0.02 | 1.3 | 1.3309 | 0.32 | −3.3 | 0.4274 | 0.04 | 0.4 |
| | 42 | 0.586 | 1.3435 | 0.48 | −1.5 | 0.5170 | 0.00 | 1.3 | 1.3352 | 0.29 | −1.2 | 0.4281 | 0.05 | −0.3 |
| | 43 | 0.601 | 1.3502 | 0.47 | −0.1 | 0.5172 | 0.02 | 0.2 | 1.3393 | 0.29 | 0.0 | 0.4287 | 0.04 | −1.1 |
| | 44 | 0.615 | 1.3570 | 0.48 | 0.7 | 0.5175 | 0.01 | −1.4 | 1.3435 | 0.29 | 0.5 | 0.4291 | 0.01 | −1.8 |
| | 45 | 0.629 | 1.3639 | 0.49 | 1.0 | 0.5175 | −0.02 | −2.5 | 1.3477 | 0.30 | 0.8 | 0.4291 | −0.02 | −2.0 |
| | 46 | 0.643 | 1.3710 | 0.51 | 1.0 | 0.5169 | −0.06 | −2.6 | 1.3521 | 0.32 | 1.1 | 0.4287 | −0.04 | −1.8 |
| | 47 | 0.658 | 1.3784 | 0.52 | 1.0 | 0.5157 | −0.10 | −2.0 | 1.3567 | 0.33 | 1.4 | 0.4278 | −0.07 | −1.1 |
| | 48 | 0.672 | 1.3859 | 0.54 | 1.2 | 0.5141 | −0.12 | −1.0 | 1.3617 | 0.35 | 1.6 | 0.4268 | −0.08 | −0.3 |
| | 49 | 0.686 | 1.3937 | 0.55 | 1.4 | 0.5123 | −0.13 | 0.1 | 1.3669 | 0.38 | 1.8 | 0.4256 | −0.08 | 0.5 |
| | 50 | 0.701 | 1.4018 | 0.58 | 1.4 | 0.5105 | −0.12 | 1.1 | 1.3725 | 0.41 | 1.9 | 0.4246 | −0.06 | 1.3 |

*(continued)*

**TABLE A.2(*b*)** ***(Continued)***

| | | | RIGHT KNEE | | | | | | RIGHT FIBULA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| | 51 | 0.715 | 1.4102 | 0.59 | 1.1 | 0.5089 | −0.10 | 1.7 | 1.3785 | 0.43 | 1.8 | 0.4238 | −0.04 | 1.9 |
| | 52 | 0.729 | 1.4188 | 0.61 | 1.1 | 0.5077 | −0.07 | 1.8 | 1.3849 | 0.46 | 1.8 | 0.4235 | −0.01 | 2.1 |
| | 53 | 0.744 | 1.4275 | 0.62 | 1.8 | 0.5069 | −0.04 | 1.6 | 1.3917 | 0.49 | 2.2 | 0.4236 | 0.02 | 1.6 |
| | 54 | 0.758 | 1.4366 | 0.66 | 3.2 | 0.5065 | −0.02 | 1.1 | 1.3988 | 0.52 | 3.0 | 0.4241 | 0.04 | 0.8 |
| | 55 | 0.772 | 1.4463 | 0.72 | 4.7 | 0.5062 | −0.01 | 0.5 | 1.4066 | 0.57 | 4.1 | 0.4247 | 0.04 | 0.2 |
| | 56 | 0.786 | 1.4571 | 0.79 | 5.7 | 0.5061 | −0.01 | −0.3 | 1.4151 | 0.64 | 5.4 | 0.4254 | 0.04 | −0.1 |
| | 57 | 0.801 | 1.4690 | 0.88 | 6.5 | 0.5059 | −0.02 | −1.0 | 1.4248 | 0.73 | 6.8 | 0.4260 | 0.04 | −0.4 |
| | 58 | 0.815 | 1.4822 | 0.98 | 7.5 | 0.5055 | −0.04 | −1.5 | 1.4359 | 0.83 | 8.5 | 0.4265 | 0.03 | −0.9 |
| | 59 | 0.829 | 1.4969 | 1.09 | 8.9 | 0.5048 | −0.06 | −2.0 | 1.4486 | 0.97 | 10.4 | 0.4269 | 0.02 | −1.5 |
| | 60 | 0.844 | 1.5135 | 1.23 | 10.6 | 0.5037 | −0.10 | −2.5 | 1.4635 | 1.13 | 12.1 | 0.4270 | −0.01 | −2.1 |
| | 61 | 0.858 | 1.5322 | 1.40 | 12.3 | 0.5021 | −0.14 | −3.1 | 1.4809 | 1.31 | 13.4 | 0.4267 | −0.04 | −2.7 |
| | 62 | 0.872 | 1.5534 | 1.58 | 13.8 | 0.4999 | −0.18 | −3.2 | 1.5011 | 1.51 | 14.2 | 0.4257 | −0.09 | −3.2 |
| | 63 | 0.887 | 1.5775 | 1.79 | 14.5 | 0.4969 | −0.23 | −2.8 | 1.5242 | 1.72 | 14.4 | 0.4242 | −0.14 | −3.3 |
| | 64 | 0.901 | 1.6046 | 2.00 | 13.8 | 0.4933 | −0.26 | −1.9 | 1.5503 | 1.93 | 14.1 | 0.4219 | −0.18 | −2.9 |
| | 65 | 0.915 | 1.6346 | 2.19 | 11.7 | 0.4894 | −0.28 | −0.8 | 1.5793 | 2.12 | 13.0 | 0.4189 | −0.22 | −2.2 |
| | 66 | 0.929 | 1.6671 | 2.33 | 9.0 | 0.4853 | −0.28 | 0.5 | 1.6110 | 2.30 | 11.4 | 0.4156 | −0.24 | −1.2 |
| | 67 | 0.944 | 1.7014 | 2.44 | 6.1 | 0.4812 | −0.27 | 2.0 | 1.6450 | 2.45 | 9.4 | 0.4119 | −0.26 | −0.1 |
| | 68 | 0.958 | 1.7369 | 2.51 | 3.5 | 0.4776 | −0.23 | 3.8 | 1.6810 | 2.57 | 7.6 | 0.4083 | −0.25 | 1.8 |
| | 69 | 0.972 | 1.7732 | 2.54 | 1.6 | 0.4747 | −0.16 | 5.6 | 1.7185 | 2.66 | 5.9 | 0.4049 | −0.20 | 4.3 |
| TOR | 70 | 0.987 | 1.8097 | 2.55 | 0.3 | 0.4730 | −0.07 | 7.1 | 1.7572 | 2.74 | 4.1 | 0.4024 | −0.12 | 6.8 |
| | 71 | 1.001 | 1.8462 | 2.55 | −0.3 | 0.4728 | 0.04 | 8.1 | 1.7967 | 2.78 | 2.3 | 0.4014 | −0.01 | 8.2 |
| | 72 | 1.015 | 1.8826 | 2.54 | −0.5 | 0.4743 | 0.16 | 8.2 | 1.8368 | 2.80 | 0.6 | 0.4021 | 0.11 | 8.0 |
| | 73 | 1.030 | 1.9190 | 2.54 | −0.8 | 0.4775 | 0.28 | 7.6 | 1.8769 | 2.80 | −0.9 | 0.4045 | 0.22 | 6.7 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 74 | 1.044 | 1.9552 | 2.52 | −1.5 | 0.4823 | 0.38 | 6.4 | 1.9168 | 2.78 | −2.2 | 0.4083 | 0.30 | 5.1 |
| | 75 | 1.058 | 1.9911 | 2.49 | −2.8 | 0.4884 | 0.46 | 4.8 | 1.9563 | 2.74 | −3.6 | 0.4132 | 0.36 | 3.7 |
| | 76 | 1.072 | 2.0265 | 2.44 | −4.3 | 0.4955 | 0.52 | 3.0 | 1.9951 | 2.68 | −4.9 | 0.4188 | 0.41 | 2.3 |
| | 77 | 1.087 | 2.0610 | 2.37 | −5.7 | 0.5032 | 0.55 | 1.0 | 2.0329 | 2.60 | −6.1 | 0.4249 | 0.43 | 0.7 |
| | 78 | 1.101 | 2.0943 | 2.28 | −6.8 | 0.5112 | 0.55 | −1.1 | 2.0694 | 2.50 | −7.0 | 0.4311 | 0.43 | −1.2 |
| | 79 | 1.115 | 2.1262 | 2.18 | −7.4 | 0.5189 | 0.52 | −2.8 | 2.1044 | 2.40 | −7.7 | 0.4371 | 0.40 | −2.9 |
| | 80 | 1.130 | 2.1565 | 2.07 | −7.7 | 0.5260 | 0.47 | −4.1 | 2.1379 | 2.28 | −8.0 | 0.4424 | 0.34 | −4.2 |
| | 81 | 1.144 | 2.1853 | 1.96 | −7.7 | 0.5323 | 0.40 | −5.0 | 2.1697 | 2.17 | −8.0 | 0.4469 | 0.28 | −5.0 |
| | 82 | 1.158 | 2.2124 | 1.85 | −7.6 | 0.5375 | 0.32 | −6.0 | 2.1999 | 2.05 | −8.1 | 0.4504 | 0.20 | −5.7 |
| | 83 | 1.173 | 2.2381 | 1.74 | −7.4 | 0.5416 | 0.23 | −6.9 | 2.2284 | 1.94 | −8.0 | 0.4527 | 0.12 | −6.1 |
| | 84 | 1.187 | 2.2622 | 1.63 | −7.2 | 0.5442 | 0.13 | −7.9 | 2.2553 | 1.82 | −7.7 | 0.4537 | 0.03 | −6.2 |
| | 85 | 1.201 | 2.2848 | 1.53 | −6.9 | 0.5452 | 0.01 | −8.7 | 2.2805 | 1.72 | −6.9 | 0.4534 | −0.06 | −5.9 |
| | 86 | 1.215 | 2.3060 | 1.44 | −6.3 | 0.5443 | −0.12 | −8.9 | 2.3043 | 1.63 | −5.5 | 0.4519 | −0.14 | −5.1 |
| | 87 | 1.230 | 2.3259 | 1.35 | −5.4 | 0.5416 | −0.25 | −8.1 | 2.3270 | 1.56 | −3.9 | 0.4493 | −0.21 | −4.0 |
| | 88 | 1.244 | 2.3446 | 1.28 | −4.0 | 0.5372 | −0.35 | −6.2 | 2.3489 | 1.51 | −2.5 | 0.4459 | −0.26 | −2.4 |
| | 89 | 1.258 | 2.3625 | 1.24 | −2.0 | 0.5315 | −0.43 | −3.6 | 2.3703 | 1.49 | −1.5 | 0.4420 | −0.28 | −0.8 |
| | 90 | 1.273 | 2.3800 | 1.22 | 0.3 | 0.5250 | −0.46 | −0.7 | 2.3914 | 1.47 | −0.9 | 0.4380 | −0.28 | 0.7 |
| | 91 | 1.287 | 2.3975 | 1.25 | 2.9 | 0.5184 | −0.45 | 2.2 | 2.4124 | 1.46 | −0.3 | 0.4341 | −0.26 | 1.6 |
| | 92 | 1.301 | 2.4156 | 1.31 | 5.4 | 0.5122 | −0.39 | 4.7 | 2.4333 | 1.46 | 0.7 | 0.4305 | −0.23 | 1.7 |
| | 93 | 1.316 | 2.4349 | 1.40 | 6.9 | 0.5071 | −0.31 | 6.2 | 2.4542 | 1.48 | 1.7 | 0.4274 | −0.21 | 1.6 |
| | 94 | 1.330 | 2.4556 | 1.51 | 7.1 | 0.5033 | −0.22 | 6.7 | 2.4756 | 1.51 | 2.5 | 0.4246 | −0.19 | 1.7 |
| | 95 | 1.344 | 2.4779 | 1.60 | 5.8 | 0.5009 | −0.12 | 6.4 | 2.4975 | 1.55 | 2.6 | 0.4220 | −0.16 | 2.3 |
| | 96 | 1.358 | 2.5014 | 1.67 | 3.7 | 0.4998 | −0.03 | 5.4 | 2.5200 | 1.59 | 2.1 | 0.4200 | −0.12 | 3.3 |
| HCR | 97 | 1.373 | 2.5257 | 1.71 | 1.3 | 0.4999 | 0.03 | 4.3 | 2.5429 | 1.61 | 1.2 | 0.4186 | −0.07 | 4.1 |
| | 98 | 1.387 | 2.5502 | 1.71 | −0.7 | 0.5008 | 0.09 | 3.4 | 2.5661 | 1.62 | −0.1 | 0.4180 | 0.00 | 4.4 |
| | 99 | 1.401 | 2.5746 | 1.69 | −2.4 | 0.5025 | 0.13 | 2.7 | 2.5893 | 1.61 | −1.9 | 0.4185 | 0.06 | 3.9 |
| | 100 | 1.416 | 2.5984 | 1.64 | −4.3 | 0.5047 | 0.17 | 1.6 | 2.6121 | 1.57 | −4.4 | 0.4197 | 0.11 | 2.2 |

*(continued)*

**TABLE A.2(*b*)** ***(Continued)***

| FRAME | TIME | RIGHT KNEE | | | | | | RIGHT FIBULA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | X | VX | AX | Y | VY | AY | X | VX | AX | Y | VY | AY |
| | S | M | M/S | M/S/S | M | M/S | M/S/S | M | M/S | M/S/S | M | M/S | M/S/S |
| 101 | 1.430 | 2.6214 | 1.56 | −6.8 | 0.5072 | 0.18 | 0.0 | 2.6341 | 1.48 | −7.5 | 0.4215 | 0.12 | 0.0 |
| 102 | 1.444 | 2.6431 | 1.45 | −9.5 | 0.5098 | 0.17 | −1.5 | 2.6545 | 1.35 | −10.6 | 0.4232 | 0.11 | −1.7 |
| 103 | 1.459 | 2.6628 | 1.29 | −11.7 | 0.5120 | 0.13 | −2.5 | 2.6727 | 1.18 | −12.7 | 0.4246 | 0.07 | −2.5 |
| 104 | 1.473 | 2.6800 | 1.11 | −12.7 | 0.5136 | 0.10 | −2.6 | 2.6883 | 0.99 | −13.3 | 0.4253 | 0.04 | −2.2 |
| 105 | 1.487 | 2.6945 | 0.93 | −12.3 | 0.5147 | 0.06 | −2.2 | 2.7010 | 0.80 | −12.6 | 0.4256 | 0.01 | −1.6 |
| 106 | 1.501 | 2.7065 | 0.76 | −11.4 | 0.5153 | 0.03 | −1.7 | 2.7111 | 0.63 | −11.4 | 0.4256 | −0.01 | −1.0 |

**TABLE A.2(*c*) Filtered Marker Kinematics—Lateral Malleolus (Ankle) and Heel**

| | | | RIGHT ANKLE | | | | | | RIGHT HEEL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| TOR | 1 | 0.000 | 0.0939 | 2.24 | 19.1 | 0.2143 | 0.80 | −6.3 | 0.0300 | 2.39 | 17.2 | 0.2360 | 1.32 | −15.9 |
| | 2 | 0.014 | 0.1279 | 2.50 | 16.4 | 0.2251 | 0.68 | −10.0 | 0.0659 | 2.59 | 12.0 | 0.2531 | 1.03 | −22.6 |
| | 3 | 0.029 | 0.1653 | 2.71 | 13.5 | 0.2337 | 0.51 | −13.2 | 0.1042 | 2.73 | 8.0 | 0.2655 | 0.67 | −26.3 |
| | 4 | 0.043 | 0.2054 | 2.88 | 10.8 | 0.2396 | 0.30 | −15.2 | 0.1440 | 2.82 | 5.7 | 0.2723 | 0.28 | −27.2 |
| | 5 | 0.057 | 0.2477 | 3.02 | 8.7 | 0.2423 | 0.07 | −16.0 | 0.1849 | 2.89 | 4.8 | 0.2734 | −0.11 | −26.1 |
| | 6 | 0.072 | 0.2917 | 3.13 | 7.4 | 0.2417 | −0.16 | −15.5 | 0.2267 | 2.96 | 5.4 | 0.2692 | −0.47 | −23.7 |
| | 7 | 0.086 | 0.3372 | 3.23 | 6.7 | 0.2379 | −0.37 | −14.1 | 0.2696 | 3.05 | 7.0 | 0.2600 | −0.79 | −20.4 |
| | 8 | 0.100 | 0.3841 | 3.32 | 6.4 | 0.2311 | −0.56 | −12.1 | 0.3138 | 3.16 | 9.0 | 0.2466 | −1.05 | −16.4 |
| | 9 | 0.114 | 0.4322 | 3.41 | 6.5 | 0.2219 | −0.72 | −9.7 | 0.3599 | 3.30 | 10.5 | 0.2299 | −1.26 | −11.9 |
| | 10 | 0.129 | 0.4817 | 3.51 | 6.7 | 0.2106 | −0.84 | −7.1 | 0.4083 | 3.46 | 11.3 | 0.2107 | −1.39 | −7.3 |
| | 11 | 0.143 | 0.5326 | 3.60 | 6.8 | 0.1979 | −0.92 | −4.0 | 0.4590 | 3.63 | 11.2 | 0.1900 | −1.47 | −3.0 |
| | 12 | 0.157 | 0.5848 | 3.70 | 6.4 | 0.1844 | −0.95 | −0.5 | 0.5120 | 3.78 | 10.5 | 0.1687 | −1.48 | 1.0 |
| | 13 | 0.172 | 0.6384 | 3.79 | 5.4 | 0.1707 | −0.93 | 3.0 | 0.5671 | 3.93 | 9.3 | 0.1477 | −1.44 | 4.5 |
| | 14 | 0.186 | 0.6931 | 3.85 | 3.7 | 0.1577 | −0.86 | 6.2 | 0.6242 | 4.05 | 7.5 | 0.1276 | −1.35 | 7.3 |
| | 15 | 0.200 | 0.7486 | 3.89 | 1.3 | 0.1460 | −0.76 | 8.6 | 0.6829 | 4.14 | 5.2 | 0.1090 | −1.23 | 9.7 |
| | 16 | 0.215 | 0.8045 | 3.89 | −1.6 | 0.1360 | −0.62 | 10.1 | 0.7427 | 4.20 | 2.1 | 0.0925 | −1.07 | 11.6 |
| | 17 | 0.229 | 0.8600 | 3.85 | −5.1 | 0.1282 | −0.47 | 10.7 | 0.8029 | 4.20 | −1.7 | 0.0783 | −0.90 | 12.9 |
| | 18 | 0.243 | 0.9145 | 3.75 | −8.8 | 0.1226 | −0.31 | 10.3 | 0.8628 | 4.15 | −6.2 | 0.0668 | −0.70 | 13.3 |
| | 19 | 0.257 | 0.9672 | 3.60 | −12.5 | 0.1192 | −0.17 | 8.9 | 0.9215 | 4.02 | −11.4 | 0.0582 | −0.51 | 12.6 |
| | 20 | 0.272 | 1.0173 | 3.39 | −16.2 | 0.1177 | −0.06 | 6.7 | 0.9779 | 3.82 | −17.1 | 0.0521 | −0.34 | 10.8 |
| | 21 | 0.286 | 1.0641 | 3.13 | −20.0 | 0.1175 | 0.02 | 3.9 | 1.0309 | 3.53 | −23.2 | 0.0483 | −0.21 | 8.1 |
| | 22 | 0.300 | 1.1068 | 2.82 | −23.6 | 0.1182 | 0.05 | 0.7 | 1.0790 | 3.16 | −28.9 | 0.0462 | −0.11 | 4.6 |

*(continued)*

**TABLE A.2(*c*)** ***(Continued)***

| | | | RIGHT ANKLE | | | | | | RIGHT HEEL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| | 23 | 0.315 | 1.1447 | 2.46 | −26.3 | 0.1190 | 0.04 | −2.5 | 1.1212 | 2.71 | −33.1 | 0.0451 | −0.07 | 1.1 |
| | 24 | 0.329 | 1.1771 | 2.07 | −27.4 | 0.1193 | −0.02 | −5.1 | 1.1565 | 2.21 | −35.2 | 0.0441 | −0.08 | −1.1 |
| | 25 | 0.343 | 1.2038 | 1.67 | −26.3 | 0.1185 | −0.11 | −6.5 | 1.1844 | 1.70 | −34.7 | 0.0428 | −0.11 | −1.2 |
| | 26 | 0.357 | 1.2249 | 1.31 | −23.1 | 0.1162 | −0.21 | −6.1 | 1.2051 | 1.22 | −31.6 | 0.0411 | −0.12 | 0.4 |
| | 27 | 0.372 | 1.2413 | 1.01 | −18.3 | 0.1126 | −0.28 | −3.7 | 1.2192 | 0.80 | −26.1 | 0.0395 | −0.09 | 2.4 |
| HCR | 28 | 0.386 | 1.2539 | 0.79 | −13.3 | 0.1081 | −0.31 | −0.2 | 1.2280 | 0.47 | −19.3 | 0.0384 | −0.05 | 3.5 |
| | 29 | 0.400 | 1.2639 | 0.63 | −9.2 | 0.1037 | −0.29 | 3.0 | 1.2327 | 0.25 | −12.5 | 0.0381 | 0.01 | 3.3 |
| | 30 | 0.415 | 1.2720 | 0.53 | −6.7 | 0.0999 | −0.23 | 4.6 | 1.2350 | 0.11 | −6.8 | 0.0385 | 0.05 | 2.1 |
| | 31 | 0.429 | 1.2789 | 0.44 | −5.5 | 0.0972 | −0.16 | 4.7 | 1.2360 | 0.05 | −2.7 | 0.0394 | 0.07 | 0.9 |
| | 32 | 0.443 | 1.2846 | 0.37 | −5.1 | 0.0955 | −0.09 | 3.7 | 1.2365 | 0.04 | −0.4 | 0.0404 | 0.07 | 0.1 |
| | 33 | 0.458 | 1.2894 | 0.30 | −4.8 | 0.0945 | −0.05 | 2.3 | 1.2370 | 0.04 | 0.5 | 0.0414 | 0.07 | −0.3 |
| | 34 | 0.472 | 1.2931 | 0.23 | −4.3 | 0.0940 | −0.03 | 1.2 | 1.2377 | 0.05 | 0.8 | 0.0424 | 0.06 | −0.4 |
| | 35 | 0.486 | 1.2960 | 0.18 | −3.3 | 0.0937 | −0.02 | 0.6 | 1.2384 | 0.06 | 0.9 | 0.0432 | 0.06 | −0.3 |
| | 36 | 0.500 | 1.2982 | 0.14 | −2.4 | 0.0935 | −0.01 | 0.5 | 1.2394 | 0.08 | 0.9 | 0.0440 | 0.05 | −0.5 |
| | 37 | 0.515 | 1.2999 | 0.11 | −1.9 | 0.0934 | 0.00 | 0.5 | 1.2406 | 0.09 | 0.2 | 0.0448 | 0.05 | −0.8 |
| | 38 | 0.529 | 1.3012 | 0.08 | −2.1 | 0.0935 | 0.01 | 0.4 | 1.2419 | 0.08 | −1.1 | 0.0453 | 0.03 | −1.0 |
| | 39 | 0.543 | 1.3022 | 0.05 | −2.2 | 0.0936 | 0.01 | 0.3 | 1.2429 | 0.06 | −2.2 | 0.0457 | 0.02 | −0.9 |
| | 40 | 0.558 | 1.3026 | 0.02 | −2.0 | 0.0938 | 0.01 | 0.5 | 1.2435 | 0.02 | −2.5 | 0.0458 | 0.00 | −0.6 |
| | 41 | 0.572 | 1.3026 | −0.01 | −1.3 | 0.0940 | 0.02 | 1.0 | 1.2435 | −0.01 | −1.8 | 0.0458 | 0.00 | 0.0 |
| | 42 | 0.586 | 1.3023 | −0.02 | −0.5 | 0.0945 | 0.04 | 1.3 | 1.2431 | −0.03 | −0.7 | 0.0458 | 0.00 | 0.6 |
| | 43 | 0.601 | 1.3020 | −0.02 | 0.3 | 0.0952 | 0.06 | 1.2 | 1.2425 | −0.04 | 0.3 | 0.0459 | 0.02 | 1.1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | 0.615 | 1.3017 | −0.01 | 0.9 | 0.0962 | 0.08 | 0.6 | 1.2421 | −0.02 | 1.1 | 0.0463 | 0.04 | 1.0 |
| 45 | 0.629 | 1.3016 | 0.00 | 1.5 | 0.0974 | 0.08 | −0.2 | 1.2418 | 0.00 | 1.6 | 0.0469 | 0.05 | 0.5 |
| 46 | 0.643 | 1.3018 | 0.03 | 1.7 | 0.0985 | 0.07 | −0.9 | 1.2420 | 0.02 | 1.8 | 0.0477 | 0.05 | −0.1 |
| 47 | 0.658 | 1.3024 | 0.05 | 1.6 | 0.0994 | 0.05 | −1.1 | 1.2425 | 0.05 | 1.7 | 0.0484 | 0.04 | −0.5 |
| 48 | 0.672 | 1.3034 | 0.07 | 1.3 | 0.1000 | 0.04 | −0.9 | 1.2433 | 0.07 | 1.6 | 0.0489 | 0.03 | −0.5 |
| 49 | 0.686 | 1.3046 | 0.09 | 0.9 | 0.1005 | 0.03 | −0.3 | 1.2445 | 0.09 | 1.3 | 0.0494 | 0.03 | 0.1 |
| 50 | 0.701 | 1.3059 | 0.10 | 0.5 | 0.1009 | 0.03 | 0.3 | 1.2460 | 0.11 | 0.9 | 0.0498 | 0.04 | 1.2 |
| 51 | 0.715 | 1.3074 | 0.11 | 0.1 | 0.1014 | 0.04 | 0.8 | 1.2477 | 0.12 | 0.2 | 0.0504 | 0.06 | 2.3 |
| 52 | 0.729 | 1.3090 | 0.10 | −0.4 | 0.1020 | 0.05 | 1.4 | 1.2494 | 0.12 | −0.6 | 0.0516 | 0.10 | 3.1 |
| 53 | 0.744 | 1.3104 | 0.10 | −0.5 | 0.1029 | 0.08 | 1.9 | 1.2510 | 0.10 | −0.9 | 0.0534 | 0.15 | 3.4 |
| 54 | 0.758 | 1.3117 | 0.09 | −0.2 | 0.1042 | 0.11 | 2.6 | 1.2523 | 0.09 | −0.6 | 0.0559 | 0.20 | 3.5 |
| 55 | 0.772 | 1.3129 | 0.09 | 0.3 | 0.1061 | 0.15 | 3.2 | 1.2536 | 0.08 | −0.3 | 0.0591 | 0.25 | 3.5 |
| 56 | 0.786 | 1.3142 | 0.10 | 0.8 | 0.1086 | 0.20 | 3.6 | 1.2547 | 0.08 | −0.1 | 0.0631 | 0.30 | 3.5 |
| 57 | 0.801 | 1.3157 | 0.11 | 1.4 | 0.1118 | 0.25 | 3.6 | 1.2559 | 0.08 | 0.3 | 0.0677 | 0.35 | 3.8 |
| 58 | 0.815 | 1.3174 | 0.14 | 2.7 | 0.1158 | 0.30 | 3.2 | 1.2571 | 0.09 | 1.5 | 0.0731 | 0.41 | 4.6 |
| 59 | 0.829 | 1.3196 | 0.19 | 4.7 | 0.1205 | 0.35 | 3.2 | 1.2585 | 0.12 | 3.5 | 0.0794 | 0.48 | 5.9 |
| 60 | 0.844 | 1.3227 | 0.27 | 7.2 | 0.1257 | 0.39 | 3.5 | 1.2606 | 0.19 | 6.1 | 0.0869 | 0.58 | 7.4 |
| 61 | 0.858 | 1.3274 | 0.39 | 9.8 | 0.1317 | 0.45 | 4.0 | 1.2640 | 0.30 | 9.1 | 0.0960 | 0.69 | 8.5 |
| 62 | 0.872 | 1.3340 | 0.55 | 12.2 | 0.1385 | 0.51 | 4.4 | 1.2692 | 0.45 | 12.3 | 0.1068 | 0.82 | 9.3 |
| 63 | 0.887 | 1.3432 | 0.74 | 14.0 | 0.1463 | 0.57 | 4.5 | 1.2769 | 0.65 | 15.4 | 0.1195 | 0.96 | 9.9 |
| 64 | 0.901 | 1.3552 | 0.95 | 15.0 | 0.1549 | 0.64 | 4.4 | 1.2878 | 0.89 | 17.8 | 0.1343 | 1.11 | 10.0 |
| 65 | 0.915 | 1.3704 | 1.17 | 15.3 | 0.1645 | 0.70 | 3.6 | 1.3024 | 1.16 | 19.1 | 0.1511 | 1.25 | 9.1 |
| 66 | 0.929 | 1.3887 | 1.39 | 15.2 | 0.1749 | 0.74 | 2.2 | 1.3210 | 1.44 | 19.2 | 0.1700 | 1.37 | 6.1 |
| 67 | 0.944 | 1.4101 | 1.61 | 15.1 | 0.1857 | 0.76 | 0.6 | 1.3436 | 1.71 | 18.0 | 0.1902 | 1.42 | 0.8 |
| 68 | 0.958 | 1.4346 | 1.82 | 14.9 | 0.1967 | 0.76 | −1.1 | 1.3699 | 1.95 | 15.8 | 0.2106 | 1.39 | −5.7 |

*(continued)*

**TABLE A.2(*c*)** ***(Continued)***

| | | | RIGHT ANKLE | | | | | | RIGHT HEEL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| | 69 | 0.972 | 1.4622 | 2.03 | 14.4 | 0.2074 | 0.73 | −3.0 | 1.3995 | 2.16 | 12.9 | 0.2299 | 1.26 | −11.7 |
| TOR | 70 | 0.987 | 1.4928 | 2.23 | 13.4 | 0.2175 | 0.67 | −5.3 | 1.4317 | 2.32 | 9.9 | 0.2467 | 1.05 | −16.4 |
| | 71 | 1.001 | 1.5261 | 2.41 | 12.2 | 0.2266 | 0.58 | −8.2 | 1.4659 | 2.44 | 7.8 | 0.2600 | 0.79 | −19.6 |
| | 72 | 1.015 | 1.5619 | 2.58 | 11.3 | 0.2340 | 0.44 | −11.3 | 1.5016 | 2.55 | 7.3 | 0.2693 | 0.49 | −21.8 |
| | 73 | 1.030 | 1.5999 | 2.74 | 10.7 | 0.2391 | 0.25 | −13.9 | 1.5387 | 2.65 | 7.8 | 0.2741 | 0.17 | −22.9 |
| | 74 | 1.044 | 1.6401 | 2.89 | 10.2 | 0.2413 | 0.04 | −15.2 | 1.5774 | 2.77 | 8.5 | 0.2741 | −0.16 | −22.6 |
| | 75 | 1.058 | 1.6824 | 3.03 | 9.7 | 0.2403 | −0.18 | −15.1 | 1.6178 | 2.89 | 9.0 | 0.2694 | −0.48 | −21.1 |
| | 76 | 1.072 | 1.7267 | 3.16 | 9.3 | 0.2361 | −0.39 | −13.8 | 1.6601 | 3.03 | 9.4 | 0.2604 | −0.76 | −18.8 |
| | 77 | 1.087 | 1.7729 | 3.29 | 8.8 | 0.2291 | −0.58 | −11.9 | 1.7044 | 3.16 | 9.8 | 0.2475 | −1.02 | −16.2 |
| | 78 | 1.101 | 1.8209 | 3.42 | 8.2 | 0.2197 | −0.73 | −9.7 | 1.7506 | 3.31 | 10.3 | 0.2314 | −1.23 | −13.3 |
| | 79 | 1.115 | 1.8706 | 3.53 | 7.5 | 0.2082 | −0.85 | −7.3 | 1.7990 | 3.46 | 10.8 | 0.2124 | −1.40 | −9.9 |
| | 80 | 1.130 | 1.9218 | 3.63 | 6.9 | 0.1953 | −0.94 | −4.5 | 1.8495 | 3.62 | 11.2 | 0.1914 | −1.51 | −5.8 |
| | 81 | 1.144 | 1.9745 | 3.72 | 6.2 | 0.1814 | −0.98 | −1.5 | 1.9024 | 3.78 | 11.3 | 0.1692 | −1.56 | −1.4 |
| | 82 | 1.158 | 2.0284 | 3.81 | 5.5 | 0.1672 | −0.98 | 1.7 | 1.9576 | 3.94 | 10.8 | 0.1467 | −1.55 | 3.0 |
| | 83 | 1.173 | 2.0834 | 3.88 | 4.6 | 0.1533 | −0.93 | 5.0 | 2.0150 | 4.09 | 9.5 | 0.1249 | −1.48 | 6.9 |
| | 84 | 1.187 | 2.1394 | 3.94 | 3.3 | 0.1405 | −0.84 | 8.1 | 2.0745 | 4.21 | 7.4 | 0.1044 | −1.35 | 10.2 |
| | 85 | 1.201 | 2.1961 | 3.98 | 1.3 | 0.1293 | −0.70 | 10.6 | 2.1354 | 4.30 | 4.5 | 0.0862 | −1.19 | 12.8 |
| | 86 | 1.215 | 2.2531 | 3.98 | −1.7 | 0.1204 | −0.54 | 11.8 | 2.1974 | 4.34 | 0.6 | 0.0705 | −0.99 | 14.5 |
| | 87 | 1.230 | 2.3098 | 3.93 | −5.8 | 0.1140 | −0.36 | 11.6 | 2.2595 | 4.32 | −4.2 | 0.0579 | −0.77 | 15.0 |
| | 88 | 1.244 | 2.3654 | 3.81 | −10.9 | 0.1100 | −0.21 | 10.2 | 2.3208 | 4.22 | −10.1 | 0.0485 | −0.56 | 14.3 |
| | 89 | 1.258 | 2.4188 | 3.61 | −16.6 | 0.1081 | −0.07 | 7.9 | 2.3801 | 4.03 | −16.9 | 0.0420 | −0.36 | 12.4 |
| | 90 | 1.273 | 2.4688 | 3.33 | −22.3 | 0.1079 | 0.02 | 4.8 | 2.4360 | 3.73 | −24.2 | 0.0381 | −0.20 | 9.5 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 91 | 1.287 | 2.5142 | 2.98 | −26.8 | 0.1087 | 0.07 | 1.1 | 2.4869 | 3.34 | −30.9 | 0.0362 | −0.09 | 6.0 |
| | 92 | 1.301 | 2.5539 | 2.57 | −29.4 | 0.1098 | 0.05 | −2.6 | 2.5314 | 2.85 | −35.8 | 0.0356 | −0.03 | 2.6 |
| | 93 | 1.316 | 2.5876 | 2.14 | −29.4 | 0.1103 | −0.01 | −5.3 | 2.5684 | 2.31 | −38.0 | 0.0354 | −0.01 | 0.2 |
| | 94 | 1.330 | 2.6151 | 1.73 | −27.1 | 0.1095 | −0.10 | −6.1 | 2.5975 | 1.76 | −37.1 | 0.0352 | −0.02 | −0.5 |
| | 95 | 1.344 | 2.6369 | 1.36 | −22.7 | 0.1074 | −0.18 | −4.5 | 2.6188 | 1.25 | −33.1 | 0.0347 | −0.03 | 0.3 |
| | 96 | 1.358 | 2.6541 | 1.08 | −17.4 | 0.1043 | −0.23 | −1.6 | 2.6333 | 0.82 | −26.6 | 0.0343 | −0.01 | 1.7 |
| HCR | 97 | 1.373 | 2.6677 | 0.87 | −12.5 | 0.1009 | −0.23 | 1.2 | 2.6422 | 0.49 | −19.1 | 0.0343 | 0.02 | 2.4 |
| | 98 | 1.387 | 2.6789 | 0.72 | −9.3 | 0.0978 | −0.19 | 2.9 | 2.6473 | 0.27 | −12.1 | 0.0349 | 0.05 | 2.0 |
| | 99 | 1.401 | 2.6882 | 0.60 | −8.0 | 0.0954 | −0.15 | 3.1 | 2.6500 | 0.14 | −6.9 | 0.0359 | 0.08 | 0.8 |
| | 100 | 1.416 | 2.6960 | 0.49 | −7.8 | 0.0936 | −0.10 | 2.5 | 2.6514 | 0.07 | −3.7 | 0.0371 | 0.08 | −0.6 |
| | 101 | 1.430 | 2.7023 | 0.38 | −7.8 | 0.0924 | −0.08 | 1.5 | 2.6521 | 0.04 | −2.2 | 0.0381 | 0.06 | −1.7 |
| | 102 | 1.444 | 2.7068 | 0.27 | −7.7 | 0.0915 | −0.06 | 0.7 | 2.6524 | 0.01 | −1.5 | 0.0388 | 0.03 | −2.3 |
| | 103 | 1.459 | 2.7098 | 0.16 | −7.0 | 0.0907 | −0.05 | 0.4 | 2.6525 | 0.00 | −1.1 | 0.0390 | 0.00 | −2.2 |
| | 104 | 1.473 | 2.7114 | 0.07 | −5.5 | 0.0899 | −0.05 | 0.5 | 2.6523 | −0.02 | −0.8 | 0.0387 | −0.03 | −1.5 |
| | 105 | 1.487 | 2.7117 | 0.00 | −3.4 | 0.0893 | −0.04 | 0.7 | 2.6519 | −0.03 | −0.4 | 0.0381 | −0.05 | −0.6 |
| | 106 | 1.501 | 2.7114 | −0.03 | −1.2 | 0.0888 | −0.03 | 0.8 | 2.6515 | −0.03 | −0.1 | 0.0373 | −0.05 | 0.2 |

**TABLE A.2(*d*) Filtered Marker Kinematics—Fifth Metatarsal and Toe**

| | | | RIGHT METATARSAL | | | | | | RIGHT TOE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| TOR | 1 | 0.000 | 0.0845 | 1.63 | 33.7 | 0.0926 | 0.83 | −3.5 | 0.1283 | 1.34 | 38.1 | 0.0464 | 0.35 | 5.6 |
| | 2 | 0.014 | 0.1114 | 2.12 | 33.5 | 0.1042 | 0.74 | −9.6 | 0.1515 | 1.92 | 40.8 | 0.0521 | 0.40 | 1.3 |
| | 3 | 0.029 | 0.1452 | 2.59 | 30.8 | 0.1137 | 0.56 | −14.4 | 0.1833 | 2.51 | 39.0 | 0.0580 | 0.38 | −4.1 |
| | 4 | 0.043 | 0.1854 | 3.00 | 26.7 | 0.1201 | 0.33 | −17.1 | 0.2232 | 3.04 | 34.1 | 0.0630 | 0.29 | −8.4 |
| | 5 | 0.057 | 0.2311 | 3.35 | 22.4 | 0.1230 | 0.07 | −17.4 | 0.2702 | 3.48 | 28.1 | 0.0662 | 0.14 | −10.3 |
| | 6 | 0.072 | 0.2813 | 3.64 | 18.4 | 0.1222 | −0.17 | −15.9 | 0.3229 | 3.84 | 22.3 | 0.0671 | −0.01 | −9.8 |
| | 7 | 0.086 | 0.3353 | 3.88 | 15.0 | 0.1180 | −0.38 | −13.0 | 0.3801 | 4.12 | 17.1 | 0.0659 | −0.14 | −7.7 |
| | 8 | 0.100 | 0.3923 | 4.07 | 12.0 | 0.1112 | −0.55 | −9.2 | 0.4407 | 4.33 | 12.7 | 0.0631 | −0.23 | −4.6 |
| | 9 | 0.114 | 0.4517 | 4.22 | 9.4 | 0.1024 | −0.65 | −4.8 | 0.5039 | 4.48 | 8.9 | 0.0594 | −0.27 | −1.2 |
| | 10 | 0.129 | 0.5130 | 4.34 | 7.1 | 0.0927 | −0.68 | −0.5 | 0.5689 | 4.59 | 5.6 | 0.0554 | −0.26 | 2.1 |
| | 11 | 0.143 | 0.5758 | 4.43 | 5.0 | 0.0828 | −0.66 | 3.2 | 0.6351 | 4.64 | 2.8 | 0.0518 | −0.21 | 5.2 |
| | 12 | 0.157 | 0.6396 | 4.48 | 3.0 | 0.0737 | −0.59 | 6.5 | 0.7018 | 4.67 | 0.3 | 0.0493 | −0.12 | 7.8 |
| | 13 | 0.172 | 0.7040 | 4.51 | 0.9 | 0.0659 | −0.48 | 9.2 | 0.7685 | 4.65 | −2.1 | 0.0485 | 0.01 | 10.1 |
| | 14 | 0.186 | 0.7686 | 4.51 | −1.3 | 0.0601 | −0.33 | 11.1 | 0.8349 | 4.61 | −4.5 | 0.0497 | 0.17 | 11.7 |
| | 15 | 0.200 | 0.8330 | 4.47 | −3.6 | 0.0565 | −0.16 | 12.3 | 0.9003 | 4.52 | −7.1 | 0.0534 | 0.35 | 12.6 |
| | 16 | 0.215 | 0.8966 | 4.41 | −5.8 | 0.0555 | 0.02 | 12.7 | 0.9642 | 4.40 | −9.9 | 0.0596 | 0.53 | 12.8 |
| | 17 | 0.229 | 0.9590 | 4.31 | −8.5 | 0.0572 | 0.20 | 12.5 | 1.0262 | 4.24 | −13.2 | 0.0686 | 0.71 | 11.9 |
| | 18 | 0.243 | 1.0197 | 4.16 | −12.1 | 0.0614 | 0.38 | 11.2 | 1.0855 | 4.03 | −16.8 | 0.0801 | 0.87 | 9.5 |
| | 19 | 0.257 | 1.0780 | 3.96 | −16.6 | 0.0680 | 0.53 | 8.7 | 1.1414 | 3.76 | −20.2 | 0.0936 | 0.99 | 5.7 |
| | 20 | 0.272 | 1.1330 | 3.69 | −21.4 | 0.0765 | 0.63 | 4.5 | 1.1930 | 3.45 | −23.1 | 0.1083 | 1.04 | 0.6 |
| | 21 | 0.286 | 1.1835 | 3.35 | −25.7 | 0.0859 | 0.66 | −0.9 | 1.2400 | 3.10 | −25.2 | 0.1232 | 1.00 | −5.5 |
| | 22 | 0.300 | 1.2288 | 2.95 | −28.9 | 0.0952 | 0.60 | −7.2 | 1.2817 | 2.73 | −26.4 | 0.1370 | 0.88 | −12.1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 0.315 | 1.2680 | 2.52 | −30.8 | 0.1031 | 0.45 | −13.2 | 1.3180 | 2.35 | −26.8 | 0.1483 | 0.66 | −18.5 |
| | 24 | 0.329 | 1.3009 | 2.07 | −31.0 | 0.1081 | 0.22 | −17.6 | 1.3488 | 1.96 | −26.1 | 0.1558 | 0.35 | −23.5 |
| | 25 | 0.343 | 1.3274 | 1.63 | −29.5 | 0.1094 | −0.05 | −19.2 | 1.3741 | 1.60 | −23.9 | 0.1583 | −0.01 | −25.5 |
| | 26 | 0.357 | 1.3477 | 1.23 | −25.9 | 0.1066 | −0.33 | −17.7 | 1.3945 | 1.28 | −20.3 | 0.1554 | −0.38 | −24.1 |
| | 27 | 0.372 | 1.3626 | 0.89 | −21.0 | 0.1001 | −0.56 | −13.5 | 1.4107 | 1.02 | −15.8 | 0.1474 | −0.70 | −19.4 |
| HCR | 28 | 0.386 | 1.3732 | 0.63 | −15.6 | 0.0907 | −0.71 | −7.6 | 1.4237 | 0.83 | −11.9 | 0.1353 | −0.94 | −12.6 |
| | 29 | 0.400 | 1.3807 | 0.45 | −10.9 | 0.0797 | −0.78 | −1.4 | 1.4343 | 0.68 | −9.2 | 0.1206 | −1.06 | −4.9 |
| | 30 | 0.415 | 1.3860 | 0.32 | −7.3 | 0.0685 | −0.75 | 4.0 | 1.4432 | 0.56 | −7.7 | 0.1050 | −1.08 | 2.4 |
| | 31 | 0.429 | 1.3899 | 0.24 | −5.1 | 0.0582 | −0.66 | 7.9 | 1.4504 | 0.46 | −6.9 | 0.0898 | −0.99 | 8.2 |
| | 32 | 0.443 | 1.3928 | 0.18 | −3.7 | 0.0496 | −0.53 | 9.9 | 1.4563 | 0.37 | −6.2 | 0.0765 | −0.84 | 11.9 |
| | 33 | 0.458 | 1.3949 | 0.13 | −2.8 | 0.0431 | −0.38 | 10.2 | 1.4609 | 0.28 | −5.6 | 0.0658 | −0.65 | 13.2 |
| | 34 | 0.472 | 1.3965 | 0.10 | −1.9 | 0.0387 | −0.24 | 9.0 | 1.4644 | 0.21 | −4.8 | 0.0578 | −0.46 | 12.3 |
| | 35 | 0.486 | 1.3977 | 0.08 | −1.0 | 0.0363 | −0.12 | 6.8 | 1.4668 | 0.15 | −3.7 | 0.0525 | −0.30 | 10.3 |
| | 36 | 0.500 | 1.3987 | 0.07 | −0.4 | 0.0353 | −0.04 | 4.2 | 1.4685 | 0.10 | −2.5 | 0.0492 | −0.17 | 7.7 |
| | 37 | 0.515 | 1.3997 | 0.07 | −0.5 | 0.0351 | 0.00 | 2.0 | 1.4697 | 0.07 | −1.8 | 0.0476 | −0.08 | 5.0 |
| | 38 | 0.529 | 1.4006 | 0.06 | −1.2 | 0.0353 | 0.01 | 0.5 | 1.4706 | 0.05 | −1.7 | 0.0469 | −0.03 | 2.4 |
| | 39 | 0.543 | 1.4013 | 0.03 | −1.9 | 0.0355 | 0.01 | −0.1 | 1.4712 | 0.02 | −1.7 | 0.0467 | −0.01 | 0.5 |
| | 40 | 0.558 | 1.4016 | 0.00 | −1.8 | 0.0357 | 0.01 | −0.2 | 1.4713 | 0.00 | −1.4 | 0.0466 | −0.01 | −0.5 |
| | 41 | 0.572 | 1.4014 | −0.02 | −1.2 | 0.0359 | 0.01 | −0.1 | 1.4712 | −0.02 | −0.9 | 0.0463 | −0.02 | −0.7 |
| | 42 | 0.586 | 1.4010 | −0.03 | −0.3 | 0.0360 | 0.01 | −0.2 | 1.4709 | −0.02 | −0.4 | 0.0459 | −0.03 | −0.5 |
| | 43 | 0.601 | 1.4005 | −0.03 | 0.3 | 0.0361 | 0.00 | −0.5 | 1.4705 | −0.03 | 0.1 | 0.0453 | −0.04 | −0.1 |
| | 44 | 0.615 | 1.4001 | −0.02 | 0.6 | 0.0361 | −0.01 | −0.9 | 1.4701 | −0.02 | 0.5 | 0.0448 | −0.04 | 0.0 |
| | 45 | 0.629 | 1.3998 | −0.01 | 0.6 | 0.0359 | −0.02 | −0.8 | 1.4699 | −0.01 | 0.7 | 0.0443 | −0.04 | −0.1 |
| | 46 | 0.643 | 1.3997 | 0.00 | 0.5 | 0.0355 | −0.03 | −0.3 | 1.4698 | 0.00 | 0.7 | 0.0437 | −0.04 | −0.3 |
| | 47 | 0.658 | 1.3997 | 0.00 | 0.3 | 0.0351 | −0.03 | 0.2 | 1.4698 | 0.01 | 0.7 | 0.0431 | −0.05 | −0.3 |
| | 48 | 0.672 | 1.3997 | 0.00 | 0.5 | 0.0346 | −0.02 | 0.6 | 1.4700 | 0.02 | 0.7 | 0.0424 | −0.05 | −0.2 |

*(continued)*

**TABLE A.2(*d*)** ***(Continued)***

| FRAME | TIME S | RIGHT METATARSAL X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | RIGHT TOE X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 0.686 | 1.3998 | 0.01 | 0.9 | 0.0344 | −0.01 | 0.6 | 1.4703 | 0.03 | 0.6 | 0.0417 | −0.05 | 0.0 |
| 50 | 0.701 | 1.4001 | 0.03 | 1.2 | 0.0343 | −0.01 | 0.2 | 1.4708 | 0.04 | 0.4 | 0.0410 | −0.05 | 0.3 |
| 51 | 0.715 | 1.4006 | 0.05 | 1.0 | 0.0342 | −0.01 | −0.2 | 1.4714 | 0.04 | 0.0 | 0.0403 | −0.04 | 0.5 |
| 52 | 0.729 | 1.4014 | 0.06 | 0.5 | 0.0340 | −0.01 | −0.1 | 1.4719 | 0.03 | −0.5 | 0.0397 | −0.03 | 0.6 |
| 53 | 0.744 | 1.4023 | 0.06 | −0.1 | 0.0338 | −0.01 | 0.6 | 1.4724 | 0.02 | −0.8 | 0.0393 | −0.03 | 0.6 |
| 54 | 0.758 | 1.4031 | 0.05 | −0.6 | 0.0337 | 0.00 | 1.3 | 1.4726 | 0.01 | −0.9 | 0.0390 | −0.02 | 0.8 |
| 55 | 0.772 | 1.4038 | 0.04 | −1.1 | 0.0339 | 0.03 | 1.6 | 1.4727 | 0.00 | −1.0 | 0.0388 | 0.00 | 0.8 |
| 56 | 0.786 | 1.4043 | 0.02 | −1.6 | 0.0345 | 0.05 | 1.1 | 1.4725 | −0.02 | −1.3 | 0.0389 | 0.01 | 0.7 |
| 57 | 0.801 | 1.4045 | 0.00 | −1.9 | 0.0353 | 0.06 | 0.3 | 1.4721 | −0.04 | −1.4 | 0.0390 | 0.01 | 0.2 |
| 58 | 0.815 | 1.4042 | −0.03 | −1.5 | 0.0361 | 0.06 | −0.4 | 1.4714 | −0.06 | −1.0 | 0.0393 | 0.01 | −0.3 |
| 59 | 0.829 | 1.4035 | −0.05 | −0.4 | 0.0369 | 0.05 | −0.5 | 1.4705 | −0.07 | −0.1 | 0.0394 | 0.00 | −1.0 |
| 60 | 0.844 | 1.4028 | −0.04 | 1.2 | 0.0374 | 0.04 | 0.2 | 1.4695 | −0.06 | 1.0 | 0.0394 | −0.02 | −1.7 |
| 61 | 0.858 | 1.4023 | −0.01 | 3.0 | 0.0380 | 0.05 | 1.8 | 1.4687 | −0.04 | 2.1 | 0.0390 | −0.04 | −2.1 |
| 62 | 0.872 | 1.4024 | 0.04 | 4.6 | 0.0389 | 0.09 | 4.0 | 1.4684 | 0.00 | 2.8 | 0.0381 | −0.08 | −1.8 |
| 63 | 0.887 | 1.4035 | 0.12 | 5.8 | 0.0406 | 0.17 | 6.4 | 1.4687 | 0.04 | 3.2 | 0.0368 | −0.10 | −0.8 |
| 64 | 0.901 | 1.4058 | 0.21 | 7.2 | 0.0437 | 0.27 | 8.3 | 1.4696 | 0.09 | 3.5 | 0.0353 | −0.10 | 1.0 |
| 65 | 0.915 | 1.4094 | 0.32 | 9.2 | 0.0485 | 0.40 | 9.3 | 1.4712 | 0.14 | 4.6 | 0.0340 | −0.07 | 3.0 |
| 66 | 0.929 | 1.4149 | 0.47 | 12.4 | 0.0552 | 0.54 | 9.0 | 1.4737 | 0.22 | 7.3 | 0.0333 | −0.01 | 5.0 |
| 67 | 0.944 | 1.4229 | 0.68 | 16.9 | 0.0639 | 0.66 | 7.3 | 1.4775 | 0.35 | 12.7 | 0.0337 | 0.07 | 6.3 |
| 68 | 0.958 | 1.4343 | 0.95 | 22.1 | 0.0741 | 0.75 | 4.1 | 1.4837 | 0.58 | 20.7 | 0.0354 | 0.17 | 6.4 |
| 69 | 0.972 | 1.4502 | 1.31 | 26.8 | 0.0852 | 0.78 | −0.2 | 1.4941 | 0.94 | 29.5 | 0.0385 | 0.26 | 5.4 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOR | 70 | 0.987 | 1.4717 | 1.72 | 29.7 | 0.0963 | 0.74 | −5.4 | 1.5107 | 1.43 | 36.3 | 0.0428 | 0.32 | 3.4 |
| | 71 | 1.001 | 1.4994 | 2.16 | 30.2 | 0.1063 | 0.62 | −10.6 | 1.5349 | 1.98 | 39.0 | 0.0478 | 0.35 | 0.3 |
| | 72 | 1.015 | 1.5335 | 2.59 | 28.5 | 0.1142 | 0.44 | −14.7 | 1.5673 | 2.54 | 37.5 | 0.0530 | 0.33 | −3.4 |
| | 73 | 1.030 | 1.5734 | 2.97 | 25.3 | 0.1188 | 0.20 | −16.9 | 1.6075 | 3.05 | 33.2 | 0.0574 | 0.26 | −7.0 |
| | 74 | 1.044 | 1.6185 | 3.31 | 21.7 | 0.1200 | −0.05 | −16.6 | 1.6546 | 3.49 | 27.9 | 0.0603 | 0.13 | −9.3 |
| | 75 | 1.058 | 1.6681 | 3.59 | 18.2 | 0.1175 | −0.27 | −14.3 | 1.7074 | 3.85 | 22.5 | 0.0612 | −0.01 | −9.9 |
| | 76 | 1.072 | 1.7213 | 3.83 | 15.2 | 0.1121 | −0.45 | −10.8 | 1.7647 | 4.13 | 17.5 | 0.0601 | −0.15 | −8.5 |
| | 77 | 1.087 | 1.7776 | 4.03 | 12.7 | 0.1046 | −0.58 | −7.3 | 1.8256 | 4.35 | 13.2 | 0.0570 | −0.25 | −5.7 |
| | 78 | 1.101 | 1.8365 | 4.19 | 10.4 | 0.0955 | −0.66 | −4.3 | 1.8892 | 4.51 | 9.7 | 0.0528 | −0.31 | −2.1 |
| | 79 | 1.115 | 1.8975 | 4.33 | 8.3 | 0.0856 | −0.70 | −1.4 | 1.9547 | 4.63 | 6.7 | 0.0482 | −0.31 | 1.5 |
| | 80 | 1.130 | 1.9603 | 4.43 | 6.4 | 0.0754 | −0.70 | 1.7 | 2.0215 | 4.70 | 4.0 | 0.0439 | −0.27 | 4.7 |
| | 81 | 1.144 | 2.0243 | 4.51 | 4.7 | 0.0655 | −0.66 | 4.9 | 2.0892 | 4.74 | 1.0 | 0.0406 | −0.18 | 7.5 |
| | 82 | 1.158 | 2.0892 | 4.57 | 3.1 | 0.0566 | −0.56 | 8.1 | 2.1571 | 4.73 | −1.9 | 0.0388 | −0.05 | 9.9 |
| | 83 | 1.173 | 2.1548 | 4.60 | 1.5 | 0.0493 | −0.43 | 10.9 | 2.2246 | 4.69 | −4.5 | 0.0391 | 0.11 | 12.0 |
| | 84 | 1.187 | 2.2208 | 4.61 | −0.6 | 0.0444 | −0.25 | 13.2 | 2.2912 | 4.61 | −6.5 | 0.0418 | 0.29 | 13.4 |
| | 85 | 1.201 | 2.2866 | 4.58 | −3.4 | 0.0421 | −0.05 | 14.7 | 2.3564 | 4.50 | −8.4 | 0.0474 | 0.49 | 14.0 |
| | 86 | 1.215 | 2.3518 | 4.51 | −7.0 | 0.0430 | 0.17 | 15.1 | 2.4199 | 4.37 | −10.7 | 0.0558 | 0.69 | 13.7 |
| | 87 | 1.230 | 2.4155 | 4.38 | −11.3 | 0.0469 | 0.38 | 14.2 | 2.4813 | 4.20 | −13.9 | 0.0671 | 0.88 | 12.1 |
| | 88 | 1.244 | 2.4771 | 4.19 | −16.3 | 0.0539 | 0.57 | 11.6 | 2.5399 | 3.97 | −18.0 | 0.0811 | 1.04 | 8.4 |
| | 89 | 1.258 | 2.5353 | 3.91 | −21.8 | 0.0634 | 0.71 | 6.8 | 2.5948 | 3.68 | −22.4 | 0.0968 | 1.12 | 2.6 |
| | 90 | 1.273 | 2.5890 | 3.56 | −27.2 | 0.0743 | 0.77 | 0.1 | 2.6451 | 3.33 | −26.3 | 0.1132 | 1.11 | −4.7 |
| | 91 | 1.287 | 2.6371 | 3.14 | −31.4 | 0.0853 | 0.72 | −7.3 | 2.6900 | 2.93 | −28.8 | 0.1286 | 0.99 | −12.6 |
| | 92 | 1.301 | 2.6787 | 2.66 | −33.6 | 0.0948 | 0.56 | −14.1 | 2.7289 | 2.51 | −29.5 | 0.1415 | 0.75 | −20.0 |
| | 93 | 1.316 | 2.7133 | 2.18 | −33.4 | 0.1013 | 0.31 | −18.8 | 2.7617 | 2.09 | −28.2 | 0.1501 | 0.42 | −25.4 |
| | 94 | 1.330 | 2.7410 | 1.71 | −30.8 | 0.1038 | 0.02 | −20.6 | 2.7886 | 1.70 | −25.4 | 0.1534 | 0.02 | −27.6 |

*(continued)*

**TABLE A.2(*d*)** ***(Continued)***

| | | | RIGHT METATARSAL | | | | | | RIGHT TOE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S | X M | VX M/S | AX M/S/S | Y M | VY M/S | AY M/S/S |
| | 95 | 1.344 | 2.7622 | 1.30 | −26.1 | 0.1019 | −0.28 | −19.0 | 2.8103 | 1.36 | −21.4 | 0.1508 | −0.37 | −25.8 |
| | 96 | 1.358 | 2.7781 | 0.96 | −20.4 | 0.0959 | −0.52 | −14.5 | 2.8275 | 1.09 | −16.8 | 0.1427 | −0.72 | −20.6 |
| HCR | 97 | 1.373 | 2.7898 | 0.71 | −15.0 | 0.0869 | −0.69 | −8.3 | 2.8413 | 0.88 | −12.6 | 0.1304 | −0.96 | −12.9 |
| | 98 | 1.387 | 2.7985 | 0.53 | −11.0 | 0.0762 | −0.76 | −1.9 | 2.8527 | 0.73 | −10.0 | 0.1153 | −1.08 | −4.2 |
| | 99 | 1.401 | 2.8050 | 0.40 | −8.5 | 0.0651 | −0.75 | 3.5 | 2.8621 | 0.60 | −9.0 | 0.0994 | −1.08 | 3.6 |
| | 100 | 1.416 | 2.8099 | 0.29 | −7.2 | 0.0548 | −0.66 | 7.1 | 2.8697 | 0.47 | −9.0 | 0.0843 | −0.98 | 9.3 |
| | 101 | 1.430 | 2.8134 | 0.20 | −6.2 | 0.0461 | −0.54 | 8.6 | 2.8755 | 0.34 | −8.9 | 0.0714 | −0.81 | 12.4 |
| | 102 | 1.444 | 2.8155 | 0.11 | −5.4 | 0.0393 | −0.42 | 8.5 | 2.8794 | 0.21 | −8.0 | 0.0610 | −0.63 | 12.9 |
| | 103 | 1.459 | 2.8166 | 0.04 | −4.4 | 0.0342 | −0.30 | 7.4 | 2.8816 | 0.11 | −6.3 | 0.0535 | −0.44 | 11.6 |
| | 104 | 1.473 | 2.8167 | −0.01 | −2.9 | 0.0306 | −0.21 | 6.1 | 2.8825 | 0.03 | −4.1 | 0.0483 | −0.29 | 9.2 |
| | 105 | 1.487 | 2.8162 | −0.04 | −1.1 | 0.0283 | −0.13 | 4.9 | 2.8825 | −0.01 | −1.8 | 0.0451 | −0.18 | 6.5 |
| | 106 | 1.501 | 2.8155 | −0.04 | 0.3 | 0.0270 | −0.07 | 3.5 | 2.8822 | −0.02 | −0.1 | 0.0431 | −0.11 | 4.1 |

**TABLE A.3(*a*) Linear and Angular Kinematics—Foot**

| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOR | 1 | 0.000 | 85.6 | −5.01 | 118.27 | 0.089 | 1.937 | 26.39 | 0.153 | 0.814 | −4.92 |
| | 2 | 0.014 | 82.2 | −3.11 | 138.72 | 0.120 | 2.310 | 24.92 | 0.165 | 0.707 | −9.81 |
| | 3 | 0.029 | 80.5 | −1.04 | 142.01 | 0.155 | 2.650 | 22.11 | 0.174 | 0.533 | −13.77 |
| | 4 | 0.043 | 80.5 | 0.96 | 132.71 | 0.195 | 2.942 | 18.72 | 0.180 | 0.313 | −16.13 |
| | 5 | 0.057 | 82.1 | 2.75 | 115.36 | 0.239 | 3.185 | 15.54 | 0.183 | 0.072 | −16.70 |
| | 6 | 0.072 | 85.0 | 4.25 | 93.06 | 0.287 | 3.386 | 12.91 | 0.182 | −0.164 | −15.72 |
| | 7 | 0.086 | 89.1 | 5.41 | 68.58 | 0.336 | 3.555 | 10.83 | 0.178 | −0.378 | −13.58 |
| | 8 | 0.100 | 93.9 | 6.22 | 44.92 | 0.388 | 3.696 | 9.20 | 0.171 | −0.553 | −10.64 |
| | 9 | 0.114 | 99.2 | 6.70 | 25.05 | 0.442 | 3.818 | 7.94 | 0.162 | −0.682 | −7.27 |
| | 10 | 0.129 | 104.9 | 6.93 | 10.88 | 0.497 | 3.923 | 6.90 | 0.152 | −0.761 | −3.80 |
| | 11 | 0.143 | 110.6 | 7.01 | 2.33 | 0.554 | 4.015 | 5.88 | 0.140 | −0.791 | −0.37 |
| | 12 | 0.157 | 116.3 | 7.00 | −2.26 | 0.612 | 4.092 | 4.69 | 0.129 | −0.771 | 2.99 |
| | 13 | 0.172 | 122.1 | 6.94 | −4.67 | 0.671 | 4.149 | 3.15 | 0.118 | −0.705 | 6.11 |
| | 14 | 0.186 | 127.7 | 6.87 | −5.67 | 0.731 | 4.182 | 1.18 | 0.109 | −0.597 | 8.65 |
| | 15 | 0.200 | 133.3 | 6.78 | −5.01 | 0.791 | 4.183 | −1.12 | 0.101 | −0.457 | 10.42 |
| | 16 | 0.215 | 138.8 | 6.72 | −3.24 | 0.851 | 4.150 | −3.73 | 0.096 | −0.299 | 11.39 |
| | 17 | 0.229 | 144.3 | 6.69 | −3.16 | 0.909 | 4.076 | −6.80 | 0.093 | −0.132 | 11.57 |
| | 18 | 0.243 | 149.8 | 6.63 | −8.11 | 0.967 | 3.955 | −10.45 | 0.092 | 0.032 | 10.78 |
| | 19 | 0.257 | 155.2 | 6.46 | −19.17 | 1.023 | 3.778 | −14.54 | 0.094 | 0.177 | 8.80 |
| | 20 | 0.272 | 160.4 | 6.08 | −34.96 | 1.075 | 3.539 | −18.79 | 0.097 | 0.284 | 5.61 |
| | 21 | 0.286 | 165.2 | 5.46 | −53.64 | 1.124 | 3.240 | −22.83 | 0.102 | 0.337 | 1.47 |
| | 22 | 0.300 | 169.3 | 4.55 | −73.48 | 1.168 | 2.886 | −26.24 | 0.107 | 0.326 | −3.24 |
| | 23 | 0.315 | 172.6 | 3.36 | −91.19 | 1.206 | 2.490 | −28.53 | 0.111 | 0.245 | −7.83 |

*(continued)*

**TABLE A.3(*a*)** ***(Continued)***

| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24 | 0.329 | 174.8 | 1.94 | −102.29 | 1.239 | 2.070 | −29.23 | 0.114 | 0.102 | −11.35 |
| | 25 | 0.343 | 175.8 | 0.43 | −104.08 | 1.266 | 1.654 | −27.90 | 0.114 | −0.080 | −12.86 |
| | 26 | 0.357 | 175.5 | −1.03 | −97.50 | 1.286 | 1.272 | −24.51 | 0.111 | −0.266 | −11.90 |
| | 27 | 0.372 | 174.1 | −2.36 | −85.55 | 1.302 | 0.953 | −19.64 | 0.106 | −0.420 | −8.61 |
| HCR | 28 | 0.386 | 171.7 | −3.48 | −68.80 | 1.314 | 0.710 | −14.43 | 0.099 | −0.512 | −3.92 |
| | 29 | 0.400 | 168.4 | −4.32 | −43.96 | 1.322 | 0.540 | −10.02 | 0.092 | −0.532 | 0.78 |
| | 30 | 0.415 | 164.6 | −4.74 | −10.50 | 1.329 | 0.424 | −7.03 | 0.084 | −0.490 | 4.32 |
| | 31 | 0.429 | 160.6 | −4.63 | 24.51 | 1.334 | 0.339 | −5.31 | 0.078 | −0.409 | 6.26 |
| | 32 | 0.443 | 157.0 | −4.04 | 52.05 | 1.339 | 0.272 | −4.39 | 0.073 | −0.311 | 6.77 |
| | 33 | 0.458 | 154.0 | −3.14 | 67.24 | 1.342 | 0.214 | −3.77 | 0.069 | −0.215 | 6.26 |
| | 34 | 0.472 | 151.9 | −2.11 | 68.18 | 1.345 | 0.164 | −3.06 | 0.066 | −0.132 | 5.12 |
| | 35 | 0.486 | 150.6 | −1.19 | 55.74 | 1.347 | 0.126 | −2.15 | 0.065 | −0.069 | 3.71 |
| | 36 | 0.500 | 149.9 | −0.52 | 35.86 | 1.348 | 0.103 | −1.38 | 0.064 | −0.026 | 2.36 |
| | 37 | 0.515 | 149.7 | −0.16 | 17.08 | 1.350 | 0.087 | −1.21 | 0.064 | −0.001 | 1.25 |
| | 38 | 0.529 | 149.7 | −0.03 | 4.56 | 1.351 | 0.068 | −1.64 | 0.064 | 0.010 | 0.46 |
| | 39 | 0.543 | 149.7 | −0.03 | −1.79 | 1.352 | 0.040 | −2.06 | 0.065 | 0.012 | 0.10 |
| | 40 | 0.558 | 149.6 | −0.08 | −4.87 | 1.352 | 0.009 | −1.91 | 0.065 | 0.013 | 0.16 |
| | 41 | 0.572 | 149.5 | −0.17 | −7.39 | 1.352 | −0.015 | −1.21 | 0.065 | 0.017 | 0.43 |
| | 42 | 0.586 | 149.3 | −0.29 | −10.28 | 1.352 | −0.026 | −0.40 | 0.065 | 0.025 | 0.54 |
| | 43 | 0.601 | 149.0 | −0.46 | −12.53 | 1.351 | −0.026 | 0.26 | 0.066 | 0.033 | 0.31 |
| | 44 | 0.615 | 148.6 | −0.65 | −12.14 | 1.351 | −0.018 | 0.76 | 0.066 | 0.034 | −0.11 |
| | 45 | 0.629 | 148.0 | −0.81 | −8.07 | 1.351 | −0.004 | 1.07 | 0.067 | 0.029 | −0.47 |
| | 46 | 0.643 | 147.2 | −0.88 | −1.88 | 1.351 | 0.012 | 1.10 | 0.067 | 0.021 | −0.60 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 47 | 0.658 | 146.5 | −0.86 | 3.55 | 1.351 | 0.027 | 0.96 | 0.067 | 0.012 | −0.45 |
| | 48 | 0.672 | 145.8 | −0.78 | 6.31 | 1.352 | 0.039 | 0.86 | 0.067 | 0.008 | −0.13 |
| | 49 | 0.686 | 145.2 | −0.68 | 5.50 | 1.352 | 0.052 | 0.88 | 0.067 | 0.009 | 0.13 |
| | 50 | 0.701 | 144.7 | −0.62 | 1.74 | 1.353 | 0.065 | 0.85 | 0.068 | 0.012 | 0.22 |
| | 51 | 0.715 | 144.2 | −0.63 | −2.68 | 1.354 | 0.076 | 0.55 | 0.068 | 0.015 | 0.32 |
| | 52 | 0.729 | 143.7 | −0.70 | −5.69 | 1.355 | 0.080 | 0.05 | 0.068 | 0.021 | 0.66 |
| | 53 | 0.744 | 143.1 | −0.80 | −7.38 | 1.356 | 0.077 | −0.32 | 0.068 | 0.034 | 1.25 |
| | 54 | 0.758 | 142.4 | −0.91 | −10.45 | 1.357 | 0.071 | −0.42 | 0.069 | 0.056 | 1.91 |
| | 55 | 0.772 | 141.6 | −1.10 | −17.81 | 1.358 | 0.065 | −0.41 | 0.070 | 0.088 | 2.38 |
| | 56 | 0.786 | 140.6 | −1.42 | −28.50 | 1.359 | 0.059 | −0.42 | 0.072 | 0.125 | 2.38 |
| | 57 | 0.801 | 139.2 | −1.91 | −38.25 | 1.360 | 0.053 | −0.24 | 0.074 | 0.156 | 1.90 |
| | 58 | 0.815 | 137.4 | −2.52 | −45.01 | 1.361 | 0.053 | 0.57 | 0.076 | 0.179 | 1.39 |
| | 59 | 0.829 | 135.1 | −3.20 | −49.94 | 1.362 | 0.069 | 2.14 | 0.079 | 0.196 | 1.33 |
| | 60 | 0.844 | 132.2 | −3.94 | −52.91 | 1.363 | 0.114 | 4.22 | 0.082 | 0.217 | 1.88 |
| | 61 | 0.858 | 128.6 | −4.71 | −52.39 | 1.365 | 0.190 | 6.40 | 0.085 | 0.250 | 2.88 |
| | 62 | 0.872 | 124.5 | −5.44 | −49.61 | 1.368 | 0.297 | 8.37 | 0.089 | 0.300 | 4.16 |
| | 63 | 0.887 | 119.7 | −6.13 | −47.15 | 1.373 | 0.429 | 9.90 | 0.093 | 0.369 | 5.46 |
| | 64 | 0.901 | 114.4 | −6.79 | −43.01 | 1.380 | 0.580 | 11.08 | 0.099 | 0.456 | 6.34 |
| | 65 | 0.915 | 108.6 | −7.36 | −31.69 | 1.390 | 0.746 | 12.24 | 0.106 | 0.550 | 6.44 |
| | 66 | 0.929 | 102.4 | −7.70 | −10.02 | 1.402 | 0.930 | 13.82 | 0.115 | 0.640 | 5.61 |
| | 67 | 0.944 | 96.0 | −7.65 | 21.54 | 1.417 | 1.141 | 16.00 | 0.125 | 0.711 | 3.93 |
| | 68 | 0.958 | 89.8 | −7.08 | 60.42 | 1.434 | 1.388 | 18.51 | 0.135 | 0.752 | 1.50 |
| | 69 | 0.972 | 84.4 | −5.92 | 100.83 | 1.456 | 1.671 | 20.60 | 0.146 | 0.754 | −1.62 |
| TOR | 70 | 0.987 | 80.1 | −4.20 | 133.15 | 1.482 | 1.977 | 21.55 | 0.157 | 0.706 | −5.36 |

*(continued)*

**TABLE A.3(*a*)** ***(Continued)***

| FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|
| 71 | 1.001 | 77.5 | −2.11 | 148.09 | 1.513 | 2.287 | 21.20 | 0.166 | 0.600 | −9.39 |
| 72 | 1.015 | 76.7 | 0.04 | 142.55 | 1.548 | 2.583 | 19.88 | 0.174 | 0.437 | −13.01 |
| 73 | 1.030 | 77.6 | 1.97 | 121.35 | 1.587 | 2.856 | 18.00 | 0.179 | 0.229 | −15.37 |
| 74 | 1.044 | 79.9 | 3.51 | 93.05 | 1.629 | 3.098 | 15.92 | 0.181 | −0.002 | −15.93 |
| 75 | 1.058 | 83.3 | 4.63 | 65.70 | 1.675 | 3.311 | 13.95 | 0.179 | −0.227 | −14.68 |
| 76 | 1.072 | 87.5 | 5.39 | 44.39 | 1.724 | 3.497 | 12.25 | 0.174 | −0.422 | −12.28 |
| 77 | 1.087 | 92.1 | 5.90 | 29.92 | 1.775 | 3.661 | 10.74 | 0.167 | −0.578 | −9.59 |
| 78 | 1.101 | 97.1 | 6.24 | 20.34 | 1.829 | 3.804 | 9.31 | 0.158 | −0.697 | −7.02 |
| 79 | 1.115 | 102.4 | 6.48 | 13.82 | 1.884 | 3.927 | 7.94 | 0.147 | −0.779 | −4.37 |
| 80 | 1.130 | 107.8 | 6.64 | 9.60 | 1.941 | 4.031 | 6.65 | 0.135 | −0.822 | −1.42 |
| 81 | 1.144 | 113.3 | 6.75 | 7.77 | 1.999 | 4.118 | 5.44 | 0.123 | −0.820 | 1.72 |
| 82 | 1.158 | 118.8 | 6.86 | 7.86 | 2.059 | 4.187 | 4.29 | 0.112 | −0.772 | 4.87 |
| 83 | 1.173 | 124.5 | 6.98 | 7.28 | 2.119 | 4.240 | 3.03 | 0.101 | −0.680 | 7.92 |
| 84 | 1.187 | 130.3 | 7.07 | 3.78 | 2.180 | 4.274 | 1.33 | 0.092 | −0.546 | 10.66 |
| 85 | 1.201 | 136.1 | 7.09 | −0.95 | 2.241 | 4.278 | −1.08 | 0.086 | −0.375 | 12.64 |
| 86 | 1.215 | 141.9 | 7.04 | −3.31 | 2.302 | 4.243 | −4.36 | 0.082 | −0.184 | 13.44 |
| 87 | 1.230 | 147.6 | 6.99 | −3.75 | 2.363 | 4.154 | −8.57 | 0.080 | 0.009 | 12.89 |
| 88 | 1.244 | 153.3 | 6.93 | −8.63 | 2.421 | 3.998 | −13.62 | 0.082 | 0.184 | 10.90 |
| 89 | 1.258 | 159.0 | 6.74 | −23.94 | 2.477 | 3.764 | −19.21 | 0.086 | 0.321 | 7.37 |
| 90 | 1.273 | 164.4 | 6.25 | −48.50 | 2.529 | 3.448 | −24.71 | 0.091 | 0.395 | 2.47 |
| 91 | 1.287 | 169.2 | 5.36 | −75.19 | 2.576 | 3.057 | −29.09 | 0.097 | 0.391 | −3.11 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 1.301 | 173.2 | 4.10 | −96.87 | 2.616 | 2.616 | −31.47 | 0.102 | 0.306 | −8.34 |
| | 93 | 1.316 | 175.9 | 2.59 | −110.55 | 2.650 | 2.157 | −31.41 | 0.106 | 0.153 | −12.08 |
| | 94 | 1.330 | 177.4 | 0.94 | −117.61 | 2.678 | 1.718 | −28.90 | 0.107 | −0.039 | −13.34 |
| | 95 | 1.344 | 177.5 | −0.78 | −118.51 | 2.700 | 1.331 | −24.40 | 0.105 | −0.229 | −11.78 |
| | 96 | 1.358 | 176.1 | −2.45 | −109.12 | 2.716 | 1.020 | −18.90 | 0.100 | −0.376 | −8.07 |
| HCR | 97 | 1.373 | 173.5 | −3.90 | −84.77 | 2.729 | 0.790 | −13.77 | 0.094 | −0.460 | −3.57 |
| | 98 | 1.387 | 169.7 | −4.88 | −46.31 | 2.739 | 0.626 | −10.14 | 0.087 | −0.478 | 0.46 |
| | 99 | 1.401 | 165.5 | −5.22 | −1.86 | 2.747 | 0.500 | −8.25 | 0.080 | −0.446 | 3.31 |
| | 100 | 1.416 | 161.2 | −4.93 | 36.59 | 2.753 | 0.390 | −7.47 | 0.074 | −0.384 | 4.77 |
| | 101 | 1.430 | 157.4 | −4.18 | 59.94 | 2.758 | 0.286 | −7.03 | 0.069 | −0.310 | 5.07 |
| | 102 | 1.444 | 154.3 | −3.22 | 66.68 | 2.761 | 0.189 | −6.52 | 0.065 | −0.239 | 4.60 |
| | 103 | 1.459 | 152.1 | −2.27 | 61.71 | 2.763 | 0.100 | −5.67 | 0.062 | −0.178 | 3.88 |
| | 104 | 1.473 | 150.6 | −1.45 | 51.41 | 2.764 | 0.027 | −4.22 | 0.060 | −0.128 | 3.28 |
| | 105 | 1.487 | 149.7 | −0.80 | 39.26 | 2.764 | −0.021 | −2.28 | 0.059 | −0.084 | 2.79 |
| | 106 | 1.501 | 149.3 | −0.33 | 25.63 | 2.763 | −0.038 | −0.45 | 0.058 | −0.048 | 2.13 |

**TABLE A.3(*b*) Linear and Angular Kinematics—Leg**

| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOR | 1 | 0.000 | 39.8 | −2.41 | 40.67 | 0.272 | 2.479 | 11.66 | 0.362 | 0.268 | 0.58 |
| | 2 | 0.014 | 38.0 | −1.70 | 56.27 | 0.308 | 2.618 | 7.99 | 0.366 | 0.277 | 0.37 |
| | 3 | 0.029 | 37.0 | −0.80 | 66.77 | 0.347 | 2.708 | 4.97 | 0.370 | 0.279 | −0.29 |
| | 4 | 0.043 | 36.7 | 0.21 | 71.22 | 0.386 | 2.760 | 2.66 | 0.374 | 0.268 | −1.25 |
| | 5 | 0.057 | 37.3 | 1.24 | 70.05 | 0.425 | 2.784 | 1.03 | 0.378 | 0.243 | −2.27 |
| | 6 | 0.072 | 38.8 | 2.21 | 64.35 | 0.465 | 2.789 | −0.07 | 0.381 | 0.203 | −3.27 |
| | 7 | 0.086 | 41.0 | 3.08 | 55.75 | 0.505 | 2.782 | −0.78 | 0.384 | 0.150 | −4.09 |
| | 8 | 0.100 | 43.8 | 3.81 | 46.45 | 0.545 | 2.767 | −1.20 | 0.385 | 0.086 | −4.55 |
| | 9 | 0.114 | 47.2 | 4.41 | 38.02 | 0.584 | 2.748 | −1.41 | 0.386 | 0.020 | −4.61 |
| | 10 | 0.129 | 51.0 | 4.90 | 30.50 | 0.624 | 2.727 | −1.52 | 0.386 | −0.045 | −4.42 |
| | 11 | 0.143 | 55.2 | 5.28 | 23.32 | 0.662 | 2.704 | −1.61 | 0.385 | −0.107 | −4.07 |
| | 12 | 0.157 | 59.7 | 5.56 | 16.47 | 0.701 | 2.681 | −1.73 | 0.383 | −0.162 | −3.47 |
| | 13 | 0.172 | 64.3 | 5.75 | 10.44 | 0.739 | 2.655 | −1.99 | 0.380 | −0.206 | −2.63 |
| | 14 | 0.186 | 69.1 | 5.86 | 5.57 | 0.777 | 2.624 | −2.49 | 0.377 | −0.237 | −1.74 |
| | 15 | 0.200 | 74.0 | 5.91 | 1.65 | 0.814 | 2.584 | −3.23 | 0.374 | −0.256 | −0.98 |
| | 16 | 0.215 | 78.8 | 5.91 | −2.00 | 0.851 | 2.531 | −4.22 | 0.370 | −0.265 | −0.37 |
| | 17 | 0.229 | 83.6 | 5.85 | −6.16 | 0.886 | 2.463 | −5.38 | 0.366 | −0.266 | 0.11 |
| | 18 | 0.243 | 88.4 | 5.73 | −11.89 | 0.921 | 2.378 | −6.44 | 0.362 | −0.262 | 0.45 |
| | 19 | 0.257 | 93.0 | 5.51 | −20.20 | 0.954 | 2.279 | −7.20 | 0.358 | −0.253 | 0.66 |
| | 20 | 0.272 | 97.4 | 5.16 | −31.54 | 0.986 | 2.171 | −7.72 | 0.355 | −0.243 | 0.87 |
| | 21 | 0.286 | 101.5 | 4.61 | −45.55 | 1.017 | 2.058 | −8.18 | 0.352 | −0.228 | 1.17 |
| | 22 | 0.300 | 105.0 | 3.85 | −60.60 | 1.045 | 1.938 | −8.64 | 0.348 | −0.209 | 1.35 |
| | 23 | 0.315 | 107.8 | 2.88 | −73.46 | 1.072 | 1.811 | −8.98 | 0.346 | −0.190 | 1.08 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24 | 0.329 | 109.7 | 1.75 | −80.46 | 1.097 | 1.681 | −9.03 | 0.343 | −0.178 | 0.43 |
| | 25 | 0.343 | 110.7 | 0.58 | −79.07 | 1.120 | 1.553 | −8.67 | 0.340 | −0.178 | −0.16 |
| | 26 | 0.357 | 110.7 | −0.51 | −68.79 | 1.141 | 1.433 | −7.92 | 0.338 | −0.183 | −0.14 |
| | 27 | 0.372 | 109.8 | −1.39 | −51.73 | 1.161 | 1.326 | −6.93 | 0.335 | −0.182 | 0.76 |
| HCR | 28 | 0.386 | 108.4 | −1.99 | −32.87 | 1.179 | 1.235 | −5.87 | 0.333 | −0.161 | 2.26 |
| | 29 | 0.400 | 106.6 | −2.33 | −18.01 | 1.196 | 1.158 | −4.90 | 0.331 | −0.117 | 3.67 |
| | 30 | 0.415 | 104.6 | −2.50 | −9.85 | 1.212 | 1.095 | −4.10 | 0.329 | −0.056 | 4.33 |
| | 31 | 0.429 | 102.5 | −2.61 | −6.21 | 1.228 | 1.041 | −3.70 | 0.329 | −0.007 | 3.99 |
| | 32 | 0.443 | 100.3 | −2.68 | −2.78 | 1.242 | 0.989 | −4.01 | 0.330 | 0.058 | 2.75 |
| | 33 | 0.458 | 98.1 | −2.69 | 2.90 | 1.256 | 0.926 | −5.05 | 0.331 | 0.086 | 0.98 |
| | 34 | 0.472 | 95.9 | −2.60 | 10.00 | 1.269 | 0.844 | −6.23 | 0.332 | 0.086 | −0.67 |
| | 35 | 0.486 | 93.8 | −2.41 | 15.87 | 1.280 | 0.748 | −6.81 | 0.333 | 0.066 | −1.61 |
| | 36 | 0.500 | 91.9 | −2.15 | 18.47 | 1.290 | 0.650 | −6.62 | 0.334 | 0.040 | −1.74 |
| | 37 | 0.515 | 90.3 | −1.88 | 17.56 | 1.299 | 0.559 | −6.09 | 0.334 | 0.016 | −1.43 |
| | 38 | 0.529 | 88.9 | −1.64 | 14.51 | 1.306 | 0.475 | −5.57 | 0.334 | −0.001 | −0.98 |
| | 39 | 0.543 | 87.6 | −1.46 | 10.97 | 1.312 | 0.399 | −4.93 | 0.334 | −0.012 | −0.39 |
| | 40 | 0.558 | 86.5 | −1.33 | 7.87 | 1.317 | 0.334 | −3.89 | 0.334 | −0.012 | 0.40 |
| | 41 | 0.572 | 85.4 | −1.24 | 5.13 | 1.322 | 0.288 | −2.49 | 0.334 | 0.000 | 1.14 |
| | 42 | 0.586 | 84.4 | −1.18 | 2.56 | 1.326 | 0.263 | −1.08 | 0.334 | 0.020 | 1.31 |
| | 43 | 0.601 | 83.5 | −1.16 | 0.58 | 1.329 | 0.257 | 0.06 | 0.334 | 0.037 | 0.64 |
| | 44 | 0.615 | 82.5 | −1.17 | −0.22 | 1.333 | 0.265 | 0.82 | 0.335 | 0.038 | −0.53 |
| | 45 | 0.629 | 81.6 | −1.17 | 0.10 | 1.337 | 0.281 | 1.24 | 0.336 | 0.022 | −1.50 |
| | 46 | 0.643 | 80.6 | −1.16 | 0.69 | 1.341 | 0.300 | 1.34 | 0.336 | −0.005 | −1.86 |
| | 47 | 0.658 | 79.7 | −1.15 | 0.65 | 1.345 | 0.319 | 1.27 | 0.335 | −0.031 | −1.62 |
| | 48 | 0.672 | 78.7 | −1.14 | −0.22 | 1.350 | 0.336 | 1.21 | 0.335 | −0.051 | −0.95 |
| | 49 | 0.686 | 77.8 | −1.16 | −1.19 | 1.355 | 0.353 | 1.17 | 0.334 | −0.059 | −0.09 |

*(continued)*

**TABLE A.3(*b*)** ***(Continued)***

| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 0.701 | 76.8 | −1.18 | −1.64 | 1.360 | 0.370 | 1.00 | 0.333 | −0.053 | 0.72 |
| | 51 | 0.715 | 75.9 | −1.20 | −1.93 | 1.366 | 0.382 | 0.66 | 0.332 | −0.038 | 1.30 |
| | 52 | 0.729 | 74.9 | −1.23 | −2.99 | 1.371 | 0.389 | 0.45 | 0.332 | −0.016 | 1.62 |
| | 53 | 0.744 | 73.8 | −1.29 | −5.30 | 1.377 | 0.395 | 0.80 | 0.332 | 0.009 | 1.74 |
| | 54 | 0.758 | 72.7 | −1.39 | −8.47 | 1.383 | 0.411 | 1.72 | 0.332 | 0.034 | 1.74 |
| | 55 | 0.772 | 71.6 | −1.53 | −11.61 | 1.389 | 0.444 | 2.77 | 0.333 | 0.058 | 1.66 |
| | 56 | 0.786 | 70.2 | −1.72 | −13.88 | 1.395 | 0.491 | 3.58 | 0.334 | 0.081 | 1.43 |
| | 57 | 0.801 | 68.7 | −1.93 | −14.88 | 1.403 | 0.547 | 4.29 | 0.335 | 0.099 | 1.00 |
| | 58 | 0.815 | 67.1 | −2.14 | −14.71 | 1.411 | 0.613 | 5.39 | 0.337 | 0.110 | 0.53 |
| | 59 | 0.829 | 65.2 | −2.35 | −14.08 | 1.420 | 0.701 | 7.07 | 0.338 | 0.114 | 0.23 |
| | 60 | 0.844 | 63.2 | −2.55 | −13.69 | 1.431 | 0.816 | 9.13 | 0.340 | 0.116 | 0.09 |
| | 61 | 0.858 | 61.1 | −2.74 | −13.68 | 1.443 | 0.962 | 11.25 | 0.342 | 0.117 | 0.00 |
| | 62 | 0.872 | 58.7 | −2.94 | −13.46 | 1.458 | 1.137 | 13.11 | 0.343 | 0.116 | 0.06 |
| | 63 | 0.887 | 56.2 | −3.13 | −11.96 | 1.476 | 1.337 | 14.27 | 0.345 | 0.118 | 0.37 |
| | 64 | 0.901 | 53.6 | −3.28 | −8.16 | 1.497 | 1.545 | 14.31 | 0.347 | 0.127 | 0.82 |
| | 65 | 0.915 | 50.9 | −3.36 | −1.88 | 1.520 | 1.746 | 13.29 | 0.349 | 0.142 | 1.13 |
| | 66 | 0.929 | 48.1 | −3.33 | 6.33 | 1.547 | 1.926 | 11.68 | 0.351 | 0.159 | 1.26 |
| | 67 | 0.944 | 45.4 | −3.18 | 15.67 | 1.575 | 2.080 | 9.99 | 0.353 | 0.178 | 1.39 |
| | 68 | 0.958 | 42.9 | −2.88 | 25.25 | 1.606 | 2.211 | 8.47 | 0.356 | 0.199 | 1.66 |
| | 69 | 0.972 | 40.7 | −2.46 | 34.20 | 1.639 | 2.322 | 7.11 | 0.359 | 0.225 | 1.88 |
| TOR | 70 | 0.987 | 38.9 | −1.91 | 42.20 | 1.672 | 2.415 | 5.93 | 0.362 | 0.253 | 1.75 |
| | 71 | 1.001 | 37.6 | −1.25 | 49.54 | 1.708 | 2.492 | 5.10 | 0.366 | 0.275 | 1.03 |
| | 72 | 1.015 | 36.8 | −0.49 | 56.03 | 1.744 | 2.560 | 4.60 | 0.370 | 0.282 | −0.23 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 73 | 1.030 | 36.8 | 0.35 | 60.38 | 1.781 | 2.624 | 4.17 | 0.374 | 0.269 | −1.71 |
| | 74 | 1.044 | 37.4 | 1.24 | 61.40 | 1.819 | 2.680 | 3.53 | 0.378 | 0.234 | −2.97 |
| | 75 | 1.058 | 38.8 | 2.11 | 58.96 | 1.857 | 2.725 | 2.64 | 0.381 | 0.184 | −3.79 |
| | 76 | 1.072 | 40.9 | 2.92 | 53.72 | 1.897 | 2.755 | 1.59 | 0.383 | 0.125 | −4.25 |
| | 77 | 1.087 | 43.6 | 3.65 | 46.69 | 1.936 | 2.770 | 0.57 | 0.385 | 0.062 | −4.57 |
| | 78 | 1.101 | 46.8 | 4.26 | 38.96 | 1.976 | 2.771 | −0.31 | 0.385 | −0.006 | −4.80 |
| | 79 | 1.115 | 50.6 | 4.76 | 31.29 | 2.016 | 2.761 | −0.96 | 0.384 | −0.075 | −4.73 |
| | 80 | 1.130 | 54.6 | 5.15 | 24.07 | 2.055 | 2.744 | −1.39 | 0.383 | −0.141 | −4.26 |
| | 81 | 1.144 | 59.0 | 5.45 | 17.67 | 2.094 | 2.722 | −1.68 | 0.380 | −0.197 | −3.51 |
| | 82 | 1.158 | 63.6 | 5.66 | 12.52 | 2.133 | 2.696 | −1.93 | 0.377 | −0.241 | −2.66 |
| | 83 | 1.173 | 68.3 | 5.81 | 8.73 | 2.171 | 2.667 | −2.22 | 0.373 | −0.273 | −1.78 |
| | 84 | 1.187 | 73.1 | 5.91 | 6.21 | 2.209 | 2.632 | −2.66 | 0.369 | −0.292 | −0.96 |
| | 85 | 1.201 | 78.0 | 5.98 | 4.43 | 2.246 | 2.590 | −3.35 | 0.365 | −0.301 | −0.35 |
| | 86 | 1.215 | 82.9 | 6.04 | 1.90 | 2.283 | 2.536 | −4.35 | 0.361 | −0.302 | 0.05 |
| | 87 | 1.230 | 87.9 | 6.04 | −3.69 | 2.319 | 2.466 | −5.61 | 0.356 | −0.299 | 0.43 |
| | 88 | 1.244 | 92.8 | 5.93 | −14.21 | 2.354 | 2.376 | −6.98 | 0.352 | −0.290 | 0.92 |
| | 89 | 1.258 | 97.6 | 5.63 | −29.76 | 2.387 | 2.266 | −8.35 | 0.348 | −0.273 | 1.38 |
| | 90 | 1.273 | 102.0 | 5.08 | −48.61 | 2.418 | 2.137 | −9.47 | 0.344 | −0.250 | 1.67 |
| | 91 | 1.287 | 105.9 | 4.24 | −67.64 | 2.448 | 1.996 | −9.96 | 0.341 | −0.225 | 1.72 |
| | 92 | 1.301 | 109.0 | 3.14 | −82.66 | 2.476 | 1.853 | −9.67 | 0.338 | −0.201 | 1.54 |
| | 93 | 1.316 | 111.0 | 1.88 | −89.51 | 2.501 | 1.719 | −8.82 | 0.335 | −0.181 | 1.24 |
| | 94 | 1.330 | 112.0 | 0.58 | −85.71 | 2.525 | 1.600 | −7.71 | 0.333 | −0.166 | 1.20 |
| | 95 | 1.344 | 112.0 | −0.57 | −71.95 | 2.547 | 1.499 | −6.53 | 0.331 | −0.147 | 1.66 |
| | 96 | 1.358 | 111.1 | −1.47 | −52.52 | 2.568 | 1.414 | −5.46 | 0.329 | −0.118 | 2.38 |
| HCR | 97 | 1.373 | 109.6 | −2.08 | −33.63 | 2.587 | 1.343 | −4.69 | 0.327 | −0.079 | 2.96 |
| | 98 | 1.387 | 107.7 | −2.43 | −20.13 | 2.606 | 1.279 | −4.45 | 0.326 | −0.033 | 3.19 |

*(continued)*

**TABLE A.3(*b*)** ***(Continued)***

| FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|
| 99 | 1.401 | 105.6 | −2.65 | −12.52 | 2.624 | 1.215 | −4.84 | 0.326 | 0.012 | 2.88 |
| 100 | 1.416 | 103.4 | −2.79 | −7.44 | 2.641 | 1.141 | −5.82 | 0.327 | 0.049 | 1.96 |
| 101 | 1.430 | 101.0 | −2.86 | −1.54 | 2.656 | 1.049 | −7.22 | 0.328 | 0.068 | 0.66 |
| 102 | 1.444 | 98.7 | −2.84 | 5.68 | 2.671 | 0.934 | −8.71 | 0.329 | 0.068 | −0.54 |
| 103 | 1.459 | 96.4 | −2.70 | 12.64 | 2.683 | 0.800 | −9.67 | 0.330 | 0.053 | −1.23 |
| 104 | 1.473 | 94.2 | −2.48 | 18.05 | 2.694 | 0.658 | −9.59 | 0.330 | 0.033 | −1.29 |
| 105 | 1.487 | 92.3 | −2.19 | 21.86 | 2.702 | 0.526 | −8.48 | 0.330 | 0.016 | −0.96 |
| 106 | 1.501 | 90.7 | −1.85 | 24.55 | 2.709 | 0.415 | −6.99 | 0.331 | 0.005 | −0.61 |

**TABLE A.3(*c*) Linear and Angular Kinematics—Thigh**

| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOR | 1 | 0.000 | 82.7 | 3.29 | 24.42 | 0.430 | 2.081 | 1.36 | 0.652 | −0.052 | 4.40 |
| | 2 | 0.014 | 85.5 | 3.59 | 18.34 | 0.460 | 2.073 | −1.89 | 0.652 | 0.026 | 6.06 |
| | 3 | 0.029 | 88.6 | 3.81 | 12.48 | 0.489 | 2.027 | −3.83 | 0.653 | 0.122 | 6.86 |
| | 4 | 0.043 | 91.8 | 3.95 | 5.97 | 0.518 | 1.963 | −4.53 | 0.655 | 0.222 | 6.72 |
| | 5 | 0.057 | 95.1 | 3.98 | −1.93 | 0.546 | 1.898 | −4.32 | 0.659 | 0.314 | 5.74 |
| | 6 | 0.072 | 98.3 | 3.89 | −10.64 | 0.572 | 1.840 | −3.64 | 0.664 | 0.386 | 4.11 |
| | 7 | 0.086 | 101.4 | 3.68 | −18.57 | 0.598 | 1.793 | −2.92 | 0.670 | 0.432 | 2.20 |
| | 8 | 0.100 | 104.3 | 3.36 | −24.25 | 0.624 | 1.756 | −2.45 | 0.677 | 0.449 | 0.42 |
| | 9 | 0.114 | 106.9 | 2.99 | −27.38 | 0.648 | 1.724 | −2.28 | 0.683 | 0.444 | −1.15 |
| | 10 | 0.129 | 109.2 | 2.58 | −28.82 | 0.673 | 1.691 | −2.31 | 0.689 | 0.417 | −2.60 |
| | 11 | 0.143 | 111.2 | 2.16 | −29.42 | 0.697 | 1.658 | −2.41 | 0.695 | 0.369 | −3.94 |
| | 12 | 0.157 | 112.8 | 1.74 | −29.22 | 0.720 | 1.622 | −2.53 | 0.700 | 0.304 | −4.97 |
| | 13 | 0.172 | 114.0 | 1.33 | −27.99 | 0.743 | 1.585 | −2.69 | 0.704 | 0.227 | −5.63 |
| | 14 | 0.186 | 114.9 | 0.94 | −26.18 | 0.766 | 1.545 | −2.83 | 0.706 | 0.143 | −6.02 |
| | 15 | 0.200 | 115.6 | 0.58 | −24.68 | 0.787 | 1.504 | −2.79 | 0.708 | 0.055 | −6.22 |
| | 16 | 0.215 | 115.9 | 0.23 | −23.85 | 0.809 | 1.466 | −2.51 | 0.708 | −0.035 | −6.23 |
| | 17 | 0.229 | 115.9 | −0.11 | −23.01 | 0.829 | 1.433 | −2.04 | 0.707 | −0.123 | −5.97 |
| | 18 | 0.243 | 115.7 | −0.43 | −20.96 | 0.850 | 1.407 | −1.40 | 0.704 | −0.206 | −5.34 |
| | 19 | 0.257 | 115.2 | −0.70 | −16.94 | 0.870 | 1.393 | −0.55 | 0.701 | −0.276 | −4.22 |
| | 20 | 0.272 | 114.6 | −0.91 | −11.04 | 0.889 | 1.392 | 0.42 | 0.696 | −0.326 | −2.51 |
| | 21 | 0.286 | 113.7 | −1.02 | −4.04 | 0.909 | 1.405 | 1.38 | 0.692 | −0.348 | −0.34 |
| | 22 | 0.300 | 112.9 | −1.03 | 2.83 | 0.930 | 1.431 | 2.28 | 0.687 | −0.336 | 1.68 |
| | 23 | 0.315 | 112.1 | −0.94 | 8.12 | 0.950 | 1.470 | 3.03 | 0.682 | −0.300 | 2.98 |

*(continued)*

**TABLE A.3(*c*)** ***(Continued)***

| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24 | 0.329 | 111.3 | −0.79 | 10.77 | 0.972 | 1.518 | 3.42 | 0.678 | −0.251 | 3.50 |
| | 25 | 0.343 | 110.8 | −0.63 | 10.49 | 0.994 | 1.568 | 3.26 | 0.675 | −0.200 | 3.62 |
| | 26 | 0.357 | 110.3 | −0.49 | 7.65 | 1.016 | 1.611 | 2.48 | 0.672 | −0.148 | 3.69 |
| | 27 | 0.372 | 110.0 | −0.41 | 3.48 | 1.040 | 1.639 | 1.20 | 0.671 | −0.094 | 3.92 |
| HCR | 28 | 0.386 | 109.6 | −0.39 | 0.13 | 1.063 | 1.645 | −0.31 | 0.670 | −0.036 | 4.29 |
| | 29 | 0.400 | 109.3 | −0.41 | −0.49 | 1.087 | 1.630 | −1.67 | 0.669 | 0.029 | 4.62 |
| | 30 | 0.415 | 109.0 | −0.41 | 1.69 | 1.110 | 1.597 | −2.61 | 0.670 | 0.096 | 4.64 |
| | 31 | 0.429 | 108.6 | −0.36 | 4.27 | 1.133 | 1.555 | −3.28 | 0.672 | 0.161 | 4.04 |
| | 32 | 0.443 | 108.4 | −0.29 | 3.58 | 1.154 | 1.503 | −4.05 | 0.675 | 0.212 | 2.63 |
| | 33 | 0.458 | 108.2 | −0.26 | −2.78 | 1.175 | 1.439 | −4.94 | 0.678 | 0.236 | 0.62 |
| | 34 | 0.472 | 107.9 | −0.37 | −13.38 | 1.196 | 1.362 | −5.49 | 0.682 | 0.230 | −1.26 |
| | 35 | 0.486 | 107.6 | −0.64 | −23.43 | 1.214 | 1.282 | −5.38 | 0.685 | 0.200 | −2.26 |
| | 36 | 0.500 | 106.9 | −1.04 | −28.36 | 1.232 | 1.208 | −4.85 | 0.687 | 0.165 | −2.32 |
| | 37 | 0.515 | 105.9 | −1.45 | −26.92 | 1.249 | 1.143 | −4.43 | 0.690 | 0.134 | −2.00 |
| | 38 | 0.529 | 104.5 | −1.81 | −20.92 | 1.265 | 1.082 | −4.34 | 0.691 | 0.108 | −1.77 |
| | 39 | 0.543 | 102.9 | −2.05 | −12.96 | 1.280 | 1.019 | −4.36 | 0.693 | 0.083 | −1.52 |
| | 40 | 0.558 | 101.2 | −2.18 | −4.84 | 1.294 | 0.957 | −4.13 | 0.694 | 0.064 | −1.01 |
| | 41 | 0.572 | 99.3 | −2.19 | 2.16 | 1.307 | 0.901 | −3.50 | 0.695 | 0.054 | −0.44 |
| | 42 | 0.586 | 97.6 | −2.11 | 6.84 | 1.320 | 0.857 | −2.56 | 0.695 | 0.052 | −0.31 |
| | 43 | 0.601 | 95.9 | −1.99 | 8.52 | 1.332 | 0.828 | −1.53 | 0.696 | 0.045 | −0.97 |
| | 44 | 0.615 | 94.3 | −1.87 | 7.81 | 1.344 | 0.813 | −0.65 | 0.697 | 0.024 | −2.12 |
| | 45 | 0.629 | 92.8 | −1.77 | 6.10 | 1.355 | 0.809 | −0.07 | 0.697 | −0.015 | −2.99 |
| | 46 | 0.643 | 91.4 | −1.70 | 4.22 | 1.367 | 0.811 | 0.26 | 0.696 | −0.062 | −3.02 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 47 | 0.658 | 90.0 | −1.65 | 2.22 | 1.378 | 0.817 | 0.61 | 0.695 | −0.102 | −2.35 |
| | 48 | 0.672 | 88.7 | −1.63 | 0.01 | 1.390 | 0.828 | 1.15 | 0.693 | −0.129 | −1.46 |
| | 49 | 0.686 | 87.4 | −1.65 | −2.10 | 1.402 | 0.850 | 1.70 | 0.691 | −0.143 | −0.63 |
| | 50 | 0.701 | 86.0 | −1.69 | −3.38 | 1.414 | 0.877 | 1.85 | 0.689 | −0.147 | 0.01 |
| | 51 | 0.715 | 84.6 | −1.75 | −3.24 | 1.427 | 0.902 | 1.51 | 0.687 | −0.143 | 0.45 |
| | 52 | 0.729 | 83.1 | −1.79 | −1.71 | 1.440 | 0.920 | 1.16 | 0.685 | −0.134 | 0.67 |
| | 53 | 0.744 | 81.7 | −1.79 | 0.98 | 1.453 | 0.936 | 1.38 | 0.683 | −0.124 | 0.79 |
| | 54 | 0.758 | 80.2 | −1.76 | 4.63 | 1.467 | 0.960 | 2.18 | 0.681 | −0.112 | 0.78 |
| | 55 | 0.772 | 78.8 | −1.66 | 8.63 | 1.481 | 0.998 | 3.02 | 0.680 | −0.101 | 0.58 |
| | 56 | 0.786 | 77.5 | −1.51 | 11.95 | 1.495 | 1.046 | 3.58 | 0.679 | −0.095 | 0.20 |
| | 57 | 0.801 | 76.3 | −1.32 | 13.92 | 1.511 | 1.100 | 4.10 | 0.677 | −0.096 | −0.19 |
| | 58 | 0.815 | 75.3 | −1.11 | 14.82 | 1.527 | 1.163 | 5.02 | 0.676 | −0.101 | −0.46 |
| | 59 | 0.829 | 74.5 | −0.90 | 15.41 | 1.544 | 1.244 | 6.42 | 0.674 | −0.109 | −0.73 |
| | 60 | 0.844 | 73.8 | −0.67 | 16.49 | 1.562 | 1.347 | 7.98 | 0.673 | −0.121 | −1.12 |
| | 61 | 0.858 | 73.4 | −0.43 | 18.57 | 1.583 | 1.472 | 9.40 | 0.671 | −0.141 | −1.49 |
| | 62 | 0.872 | 73.1 | −0.14 | 21.54 | 1.605 | 1.616 | 10.36 | 0.669 | −0.164 | −1.58 |
| | 63 | 0.887 | 73.1 | 0.19 | 24.59 | 1.629 | 1.768 | 10.40 | 0.666 | −0.186 | −1.28 |
| | 64 | 0.901 | 73.4 | 0.56 | 27.13 | 1.655 | 1.913 | 9.09 | 0.663 | −0.201 | −0.68 |
| | 65 | 0.915 | 74.1 | 0.97 | 29.35 | 1.683 | 2.028 | 6.50 | 0.660 | −0.205 | 0.06 |
| | 66 | 0.929 | 75.0 | 1.40 | 31.19 | 1.713 | 2.099 | 3.27 | 0.658 | −0.199 | 0.94 |
| | 67 | 0.944 | 76.4 | 1.86 | 31.71 | 1.743 | 2.122 | 0.24 | 0.655 | −0.179 | 2.00 |
| | 68 | 0.958 | 78.1 | 2.31 | 30.36 | 1.774 | 2.106 | −2.10 | 0.652 | −0.142 | 3.27 |
| | 69 | 0.972 | 80.2 | 2.73 | 27.73 | 1.804 | 2.062 | −3.60 | 0.651 | 0.085 | 4.59 |
| TOR | 70 | 0.987 | 82.5 | 3.10 | 24.46 | 1.833 | 2.003 | −4.23 | 0.650 | −0.010 | 5.65 |
| | 71 | 1.001 | 85.2 | 3.43 | 20.30 | 1.861 | 1.941 | −3.96 | 0.650 | 0.076 | 6.21 |
| | 72 | 1.015 | 88.2 | 3.68 | 14.67 | 1.888 | 1.889 | −3.05 | 0.652 | 0.167 | 6.16 |

*(continued)*

**TABLE A.3(*c*)** ***(Continued)***

| FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|
| 73 | 1.030 | 91.3 | 3.85 | 7.52 | 1.915 | 1.854 | −2.02 | 0.655 | 0.253 | 5.61 |
| 74 | 1.044 | 94.5 | 3.90 | −0.87 | 1.941 | 1.832 | −1.28 | 0.659 | 0.328 | 4.76 |
| 75 | 1.058 | 97.7 | 3.82 | −10.14 | 1.967 | 1.817 | −0.93 | 0.665 | 0.389 | 3.66 |
| 76 | 1.072 | 100.7 | 3.61 | −19.00 | 1.993 | 1.805 | −0.88 | 0.671 | 0.432 | 2.15 |
| 77 | 1.087 | 103.6 | 3.28 | −25.45 | 2.019 | 1.792 | −1.09 | 0.677 | 0.451 | 0.23 |
| 78 | 1.101 | 106.1 | 2.88 | −28.34 | 2.045 | 1.774 | −1.51 | 0.683 | 0.439 | −1.77 |
| 79 | 1.115 | 108.3 | 2.47 | −27.92 | 2.070 | 1.749 | −2.07 | 0.689 | 0.400 | −3.40 |
| 80 | 1.130 | 110.1 | 2.08 | −25.47 | 2.095 | 1.715 | −2.71 | 0.695 | 0.342 | −4.45 |
| 81 | 1.144 | 111.7 | 1.74 | −22.64 | 2.119 | 1.671 | −3.30 | 0.699 | 0.273 | −5.04 |
| 82 | 1.158 | 113.0 | 1.43 | −20.83 | 2.142 | 1.620 | −3.72 | 0.703 | 0.198 | −5.39 |
| 83 | 1.173 | 114.0 | 1.14 | −20.75 | 2.165 | 1.565 | −3.87 | 0.705 | 0.119 | −5.64 |
| 84 | 1.187 | 114.9 | 0.84 | −22.11 | 2.187 | 1.510 | −3.74 | 0.706 | 0.036 | −5.90 |
| 85 | 1.201 | 115.4 | 0.51 | −23.89 | 2.208 | 1.458 | −3.37 | 0.706 | −0.050 | −6.16 |
| 86 | 1.215 | 115.7 | 0.16 | −24.95 | 2.229 | 1.413 | −2.72 | 0.705 | −0.140 | −6.20 |
| 87 | 1.230 | 115.7 | −0.20 | −24.36 | 2.249 | 1.380 | −1.76 | 0.702 | −0.227 | −5.66 |
| 88 | 1.244 | 115.4 | −0.54 | −21.36 | 2.268 | 1.363 | −0.58 | 0.698 | −0.302 | −4.43 |
| 89 | 1.258 | 114.8 | −0.81 | −15.42 | 2.288 | 1.364 | 0.58 | 0.693 | −0.354 | −2.69 |
| 90 | 1.273 | 114.0 | −0.98 | −6.72 | 2.307 | 1.380 | 1.61 | 0.688 | −0.379 | −0.70 |
| 91 | 1.287 | 113.2 | −1.01 | 3.05 | 2.327 | 1.410 | 2.71 | 0.682 | −0.374 | 1.30 |
| 92 | 1.301 | 112.4 | −0.89 | 10.92 | 2.348 | 1.457 | 3.92 | 0.677 | −0.342 | 3.07 |
| 93 | 1.316 | 111.7 | −0.69 | 14.55 | 2.369 | 1.522 | 4.86 | 0.673 | −0.287 | 4.38 |
| 94 | 1.330 | 111.3 | −0.48 | 13.64 | 2.391 | 1.596 | 5.04 | 0.669 | −0.216 | 5.19 |
| 95 | 1.344 | 110.9 | −0.30 | 9.66 | 2.415 | 1.666 | 4.28 | 0.667 | −0.138 | 5.50 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96 | 1.358 | 110.8 | −0.20 | 5.05 | 2.439 | 1.718 | 2.72 | 0.665 | −0.059 | 5.33 |
| HCR | 97 | 1.373 | 110.6 | −0.16 | 2.00 | 2.464 | 1.744 | 0.71 | 0.665 | 0.014 | 4.88 |
| | 98 | 1.387 | 110.5 | −0.14 | 1.10 | 2.489 | 1.739 | −1.30 | 0.666 | 0.080 | 4.42 |
| | 99 | 1.401 | 110.4 | −0.13 | 0.73 | 2.513 | 1.706 | −3.03 | 0.667 | 0.141 | 3.89 |
| | 100 | 1.416 | 110.3 | −0.12 | −1.58 | 2.537 | 1.652 | −4.52 | 0.670 | 0.192 | 2.92 |
| | 101 | 1.430 | 110.2 | −0.17 | −7.15 | 2.561 | 1.577 | −5.90 | 0.673 | 0.224 | 1.39 |
| | 102 | 1.444 | 110.0 | −0.33 | −14.74 | 2.583 | 1.483 | −7.13 | 0.676 | 0.231 | −0.34 |
| | 103 | 1.459 | 109.6 | −0.59 | −21.06 | 2.603 | 1.373 | −8.01 | 0.679 | 0.215 | −1.65 |
| | 104 | 1.473 | 109.0 | −0.93 | −22.96 | 2.622 | 1.254 | −8.45 | 0.682 | 0.184 | −2.18 |
| | 105 | 1.487 | 108.1 | −1.25 | −19.15 | 2.639 | 1.132 | −8.72 | 0.684 | 0.152 | −2.11 |
| | 106 | 1.501 | 107.0 | −1.48 | −10.16 | 2.654 | 1.005 | −9.40 | 0.686 | 0.124 | −1.89 |

**TABLE A.3(*d*) Linear and Angular Kinematics—½ HAT**

| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOR | 1 | 0.000 | 85.1 | 0.89 | −11.61 | 0.473 | 1.377 | 1.23 | 1.080 | 0.035 | 2.76 |
| | 2 | 0.014 | 85.7 | 0.71 | −13.17 | 0.492 | 1.379 | −0.70 | 1.081 | 0.084 | 3.89 |
| | 3 | 0.029 | 86.2 | 0.52 | −11.89 | 0.512 | 1.357 | −2.11 | 1.083 | 0.146 | 4.49 |
| | 4 | 0.043 | 86.6 | 0.37 | −8.26 | 0.531 | 1.319 | −2.87 | 1.085 | 0.212 | 4.46 |
| | 5 | 0.057 | 86.8 | 0.28 | −3.23 | 0.550 | 1.275 | −2.98 | 1.089 | 0.274 | 3.80 |
| | 6 | 0.072 | 87.0 | 0.27 | 1.64 | 0.568 | 1.234 | −2.50 | 1.093 | 0.321 | 2.60 |
| | 7 | 0.086 | 87.3 | 0.33 | 4.85 | 0.585 | 1.203 | −1.64 | 1.098 | 0.348 | 1.19 |
| | 8 | 0.100 | 87.6 | 0.41 | 6.05 | 0.602 | 1.187 | −0.74 | 1.103 | 0.355 | −0.18 |
| | 9 | 0.114 | 88.0 | 0.50 | 6.17 | 0.619 | 1.182 | −0.15 | 1.108 | 0.343 | −1.50 |
| | 10 | 0.129 | 88.4 | 0.59 | 6.19 | 0.636 | 1.183 | 0.06 | 1.113 | 0.312 | −2.81 |
| | 11 | 0.143 | 88.9 | 0.68 | 6.10 | 0.653 | 1.184 | 0.06 | 1.117 | 0.262 | −3.89 |
| | 12 | 0.157 | 89.5 | 0.76 | 5.21 | 0.670 | 1.184 | 0.06 | 1.120 | 0.201 | −4.54 |
| | 13 | 0.172 | 90.2 | 0.83 | 3.01 | 0.687 | 1.186 | 0.21 | 1.123 | 0.133 | −4.81 |
| | 14 | 0.186 | 90.9 | 0.85 | −0.12 | 0.704 | 1.190 | 0.56 | 1.124 | 0.063 | −4.87 |
| | 15 | 0.200 | 91.6 | 0.82 | −3.16 | 0.721 | 1.201 | 1.15 | 1.124 | −0.007 | −4.83 |
| | 16 | 0.215 | 92.2 | 0.76 | −5.47 | 0.738 | 1.223 | 1.93 | 1.124 | −0.075 | −4.72 |
| | 17 | 0.229 | 92.8 | 0.67 | −6.91 | 0.756 | 1.257 | 2.71 | 1.122 | −0.142 | −4.48 |
| | 18 | 0.243 | 93.3 | 0.56 | −7.30 | 0.774 | 1.300 | 3.24 | 1.120 | −0.203 | −3.98 |
| | 19 | 0.257 | 93.7 | 0.46 | −6.57 | 0.793 | 1.349 | 3.38 | 1.116 | −0.255 | −3.07 |
| | 20 | 0.272 | 94.1 | 0.37 | −4.89 | 0.813 | 1.397 | 3.11 | 1.112 | −0.291 | −1.63 |
| | 21 | 0.286 | 94.3 | 0.32 | −2.38 | 0.833 | 1.438 | 2.48 | 1.108 | −0.302 | 0.10 |
| | 22 | 0.300 | 94.6 | 0.31 | 0.85 | 0.854 | 1.468 | 1.66 | 1.104 | −0.288 | 1.53 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 0.315 | 94.8 | 0.34 | 3.98 | 0.875 | 1.486 | 0.95 | 1.100 | −0.259 | 2.21 |
| | 24 | 0.329 | 95.1 | 0.42 | 5.39 | 0.896 | 1.495 | 0.64 | 1.096 | −0.225 | 2.40 |
| | 25 | 0.343 | 95.5 | 0.50 | 3.95 | 0.918 | 1.504 | 0.91 | 1.093 | −0.190 | 2.60 |
| | 26 | 0.357 | 96.0 | 0.53 | 0.20 | 0.939 | 1.521 | 1.52 | 1.091 | −0.151 | 3.07 |
| | 27 | 0.372 | 96.4 | 0.50 | −4.14 | 0.961 | 1.548 | 1.98 | 1.089 | −0.102 | 3.79 |
| HCR | 28 | 0.386 | 96.8 | 0.41 | −7.80 | 0.984 | 1.578 | 1.91 | 1.088 | −0.042 | 4.62 |
| | 29 | 0.400 | 97.1 | 0.28 | −10.40 | 1.006 | 1.602 | 1.32 | 1.088 | 0.030 | 5.28 |
| | 30 | 0.415 | 97.2 | 0.12 | −11.97 | 1.029 | 1.616 | 0.50 | 1.089 | 0.109 | 5.48 |
| | 31 | 0.429 | 97.3 | −0.06 | −12.71 | 1.053 | 1.617 | −0.32 | 1.091 | 0.186 | 4.93 |
| | 32 | 0.443 | 97.1 | −0.25 | −12.51 | 1.076 | 1.606 | −1.04 | 1.094 | 0.250 | 3.50 |
| | 33 | 0.458 | 96.9 | −0.42 | −10.48 | 1.098 | 1.587 | −1.63 | 1.098 | 0.287 | 1.45 |
| | 34 | 0.472 | 96.4 | −0.55 | −6.07 | 1.121 | 1.560 | −1.99 | 1.102 | 0.291 | −0.50 |
| | 35 | 0.486 | 96.0 | −0.59 | −0.55 | 1.143 | 1.530 | −2.10 | 1.106 | 0.272 | −1.54 |
| | 36 | 0.500 | 95.5 | −0.56 | 3.64 | 1.165 | 1.500 | −2.10 | 1.110 | 0.247 | −1.63 |
| | 37 | 0.515 | 95.0 | −0.49 | 4.75 | 1.186 | 1.470 | −2.14 | 1.114 | 0.226 | −1.49 |
| | 38 | 0.529 | 94.7 | −0.43 | 2.67 | 1.207 | 1.439 | −2.14 | 1.117 | 0.205 | −1.69 |
| | 39 | 0.543 | 94.3 | −0.41 | −1.41 | 1.227 | 1.409 | −1.93 | 1.119 | 0.178 | −1.99 |
| | 40 | 0.558 | 94.0 | −0.47 | −5.74 | 1.247 | 1.384 | −1.49 | 1.122 | 0.148 | −1.98 |
| | 41 | 0.572 | 93.6 | −0.58 | −8.82 | 1.267 | 1.366 | −0.95 | 1.124 | 0.121 | −1.69 |
| | 42 | 0.586 | 93.0 | −0.72 | −9.90 | 1.286 | 1.356 | −0.43 | 1.125 | 0.099 | −1.57 |
| | 43 | 0.601 | 92.4 | −0.86 | −9.06 | 1.305 | 1.354 | 0.04 | 1.126 | 0.076 | −1.99 |
| | 44 | 0.615 | 91.6 | −0.98 | −7.22 | 1.325 | 1.357 | 0.42 | 1.127 | 0.042 | −2.88 |
| | 45 | 0.629 | 90.8 | −1.07 | −5.50 | 1.344 | 1.366 | 0.71 | 1.128 | −0.006 | −3.64 |
| | 46 | 0.643 | 89.9 | −1.14 | −4.17 | 1.364 | 1.378 | 0.90 | 1.127 | −0.062 | −3.69 |
| | 47 | 0.658 | 88.9 | −1.19 | −2.51 | 1.384 | 1.392 | 1.02 | 1.126 | −0.112 | −3.04 |
| | 48 | 0.672 | 87.9 | −1.21 | 0.15 | 1.404 | 1.407 | 1.07 | 1.124 | −0.149 | −2.20 |
| | 49 | 0.686 | 87.0 | −1.18 | 3.16 | 1.424 | 1.422 | 1.00 | 1.122 | −0.175 | −1.53 |

*(continued)*

**TABLE A.3(*d*)** ***(Continued)***

| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 0.701 | 86.0 | −1.12 | 4.79 | 1.444 | 1.435 | 0.80 | 1.119 | −0.192 | −1.05 |
| | 51 | 0.715 | 85.1 | −1.05 | 4.15 | 1.465 | 1.445 | 0.57 | 1.116 | −0.205 | −0.71 |
| | 52 | 0.729 | 84.3 | −1.00 | 2.30 | 1.486 | 1.452 | 0.52 | 1.113 | −0.213 | −0.43 |
| | 53 | 0.744 | 83.5 | −0.98 | 1.15 | 1.506 | 1.460 | 0.71 | 1.110 | −0.217 | −0.07 |
| | 54 | 0.758 | 82.7 | −0.97 | 1.51 | 1.527 | 1.472 | 0.94 | 1.107 | −0.215 | 0.31 |
| | 55 | 0.772 | 81.9 | −0.94 | 2.94 | 1.549 | 1.487 | 0.88 | 1.104 | −0.208 | 0.52 |
| | 56 | 0.786 | 81.2 | −0.88 | 5.03 | 1.570 | 1.497 | 0.44 | 1.101 | −0.200 | 0.55 |
| | 57 | 0.801 | 80.5 | −0.79 | 7.77 | 1.591 | 1.499 | −0.02 | 1.098 | −0.192 | 0.60 |
| | 58 | 0.815 | 79.9 | −0.66 | 10.87 | 1.613 | 1.497 | −0.02 | 1.096 | −0.183 | 0.79 |
| | 59 | 0.829 | 79.4 | −0.48 | 13.59 | 1.634 | 1.499 | 0.59 | 1.093 | −0.169 | 0.91 |
| | 60 | 0.844 | 79.1 | −0.27 | 15.25 | 1.656 | 1.513 | 1.59 | 1.091 | −0.156 | 0.79 |
| | 61 | 0.858 | 78.9 | −0.05 | 15.83 | 1.677 | 1.544 | 2.58 | 1.089 | −0.147 | 0.58 |
| | 62 | 0.872 | 79.0 | 0.18 | 15.92 | 1.700 | 1.587 | 3.10 | 1.086 | −0.140 | 0.55 |
| | 63 | 0.887 | 79.2 | 0.41 | 15.99 | 1.723 | 1.633 | 2.64 | 1.085 | −0.131 | 0.71 |
| | 64 | 0.901 | 79.7 | 0.64 | 15.90 | 1.747 | 1.663 | 0.88 | 1.083 | −0.119 | 0.95 |
| | 65 | 0.915 | 80.3 | 0.86 | 15.03 | 1.770 | 1.658 | −1.90 | 1.081 | −0.104 | 1.21 |
| | 66 | 0.929 | 81.1 | 1.07 | 12.34 | 1.794 | 1.608 | −4.71 | 1.080 | −0.085 | 1.50 |
| | 67 | 0.944 | 82.0 | 1.22 | 6.89 | 1.816 | 1.523 | −6.30 | 1.079 | −0.061 | 1.88 |
| | 68 | 0.958 | 83.1 | 1.27 | −0.81 | 1.838 | 1.428 | −6.22 | 1.078 | −0.031 | 2.43 |
| | 69 | 0.972 | 84.1 | 1.19 | −8.51 | 1.857 | 1.345 | −5.08 | 1.078 | 0.008 | 3.16 |
| TOR | 70 | 0.987 | 85.0 | 1.02 | −13.55 | 1.876 | 1.283 | −3.73 | 1.078 | 0.059 | 3.86 |
| | 71 | 1.001 | 85.8 | 0.81 | −14.47 | 1.894 | 1.239 | −2.53 | 1.079 | 0.119 | 4.26 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 72 | 1.015 | 86.3 | 0.61 | −11.76 | 1.911 | 1.210 | −1.56 | 1.082 | 0.181 | 4.25 |
| | 73 | 1.030 | 86.8 | 0.47 | −7.13 | 1.929 | 1.194 | −0.86 | 1.085 | 0.240 | 3.91 |
| | 74 | 1.044 | 87.1 | 0.40 | −2.15 | 1.946 | 1.185 | −0.45 | 1.089 | 0.293 | 3.44 |
| | 75 | 1.058 | 87.4 | 0.41 | 2.49 | 1.962 | 1.181 | −0.25 | 1.093 | 0.339 | 2.73 |
| | 76 | 1.072 | 87.8 | 0.48 | 6.25 | 1.979 | 1.178 | −0.13 | 1.098 | 0.371 | 1.47 |
| | 77 | 1.087 | 88.2 | 0.59 | 8.26 | 1.996 | 1.177 | 0.01 | 1.104 | 0.381 | −0.38 |
| | 78 | 1.101 | 88.8 | 0.71 | 7.82 | 2.013 | 1.178 | 0.23 | 1.109 | 0.360 | −2.42 |
| | 79 | 1.115 | 89.4 | 0.81 | 4.89 | 2.030 | 1.184 | 0.59 | 1.114 | 0.312 | −4.04 |
| | 80 | 1.130 | 90.1 | 0.85 | 0.35 | 2.047 | 1.195 | 1.00 | 1.118 | 0.245 | −4.95 |
| | 81 | 1.144 | 90.8 | 0.82 | −4.02 | 2.064 | 1.212 | 1.25 | 1.121 | 0.170 | −5.20 |
| | 82 | 1.158 | 91.4 | 0.74 | −6.62 | 2.082 | 1.231 | 1.20 | 1.123 | 0.096 | −5.05 |
| | 83 | 1.173 | 92.0 | 0.63 | −7.20 | 2.099 | 1.247 | 0.97 | 1.124 | 0.026 | −4.71 |
| | 84 | 1.187 | 92.5 | 0.53 | −6.49 | 2.117 | 1.259 | 0.81 | 1.124 | −0.039 | −4.37 |
| | 85 | 1.201 | 92.9 | 0.45 | −5.14 | 2.135 | 1.270 | 0.83 | 1.123 | −0.099 | −4.19 |
| | 86 | 1.215 | 93.2 | 0.38 | −3.23 | 2.154 | 1.283 | 1.00 | 1.121 | −0.159 | −4.11 |
| | 87 | 1.230 | 93.5 | 0.35 | −0.73 | 2.172 | 1.299 | 1.26 | 1.118 | −0.217 | −3.86 |
| | 88 | 1.244 | 93.8 | 0.36 | 1.86 | 2.191 | 1.319 | 1.47 | 1.115 | −0.269 | −3.18 |
| | 89 | 1.258 | 94.1 | 0.41 | 3.58 | 2.210 | 1.341 | 1.52 | 1.110 | −0.308 | −2.09 |
| | 90 | 1.273 | 94.4 | 0.47 | 3.89 | 2.229 | 1.362 | 1.48 | 1.106 | −0.329 | −0.83 |
| | 91 | 1.287 | 94.9 | 0.52 | 3.56 | 2.249 | 1.383 | 1.53 | 1.101 | −0.332 | 0.43 |
| | 92 | 1.301 | 95.3 | 0.57 | 3.94 | 2.269 | 1.406 | 1.67 | 1.096 | −0.317 | 1.62 |
| | 93 | 1.316 | 95.8 | 0.63 | 5.06 | 2.289 | 1.431 | 1.80 | 1.092 | −0.285 | 2.69 |
| | 94 | 1.330 | 96.3 | 0.71 | 5.42 | 2.309 | 1.457 | 1.92 | 1.088 | −0.240 | 3.68 |
| | 95 | 1.344 | 96.9 | 0.79 | 3.53 | 2.330 | 1.486 | 2.11 | 1.085 | −0.180 | 4.53 |
| | 96 | 1.358 | 97.6 | 0.81 | −0.84 | 2.352 | 1.517 | 2.27 | 1.083 | −0.110 | 5.12 |
| HCR | 97 | 1.373 | 98.3 | 0.76 | −6.35 | 2.374 | 1.551 | 2.12 | 1.082 | −0.034 | 5.43 |
| | 98 | 1.387 | 98.9 | 0.63 | −11.08 | 2.396 | 1.578 | 1.49 | 1.082 | 0.045 | 5.56 |

*(continued)*

**TABLE A.3(*d*)** ***(Continued)***

| FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | CofM-X M | VEL-X M/S | ACC-X M/S/S | CofM-Y M | VEL-Y M/S | ACC-Y M/S/S |
|---|---|---|---|---|---|---|---|---|---|---|
| 99 | 1.401 | 99.3 | 0.45 | −13.91 | 2.419 | 1.593 | 0.57 | 1.083 | 0.125 | 5.41 |
| 100 | 1.416 | 99.6 | 0.23 | −14.78 | 2.442 | 1.594 | −0.38 | 1.086 | 0.200 | 4.65 |
| 101 | 1.430 | 99.7 | 0.02 | −13.99 | 2.465 | 1.582 | −1.19 | 1.089 | 0.258 | 3.12 |
| 102 | 1.444 | 99.6 | −0.17 | −11.75 | 2.487 | 1.560 | −1.90 | 1.093 | 0.289 | 1.13 |
| 103 | 1.459 | 99.4 | −0.31 | −8.21 | 2.509 | 1.528 | −2.78 | 1.097 | 0.291 | −0.64 |
| 104 | 1.473 | 99.1 | −0.40 | −3.79 | 2.531 | 1.481 | −4.11 | 1.101 | 0.271 | −1.69 |
| 105 | 1.487 | 98.8 | −0.42 | 0.37 | 2.552 | 1.410 | −6.06 | 1.105 | 0.242 | −2.07 |
| 106 | 1.501 | 98.4 | −0.39 | 2.87 | 2.571 | 1.308 | −8.68 | 1.108 | 0.212 | −2.24 |

**TABLE A.4 Relative Joint Angular Kinematics—Ankle, Knee, and Hip**

| | | | ANKLE | | | KNEE | | | HIP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | THETA DEG | OMEGA R/S | ALPHA R/S/S | THETA DEG | OMEGA R/S | ALPHA R/S/S |
| TOR | 1 | 0.000 | −15.2 | −2.29 | 94.89 | 46.7 | 6.74 | −21.91 | −2.4 | 2.39 | 36.03 |
| | 2 | 0.014 | −16.4 | −0.82 | 98.72 | 52.1 | 6.23 | −46.59 | −0.2 | 2.89 | 31.50 |
| | 3 | 0.029 | −16.5 | 0.54 | 84.63 | 56.9 | 5.41 | −65.29 | 2.3 | 3.30 | 24.37 |
| | 4 | 0.043 | −15.6 | 1.60 | 63.13 | 61.0 | 4.37 | −77.66 | 5.2 | 3.58 | 14.23 |
| | 5 | 0.057 | −13.9 | 2.34 | 41.31 | 64.1 | 3.19 | −84.77 | 8.2 | 3.70 | 1.30 |
| | 6 | 0.072 | −11.7 | 2.78 | 20.10 | 66.2 | 1.94 | −87.62 | 11.3 | 3.62 | −12.28 |
| | 7 | 0.086 | −9.3 | 2.92 | −0.74 | 67.3 | 0.68 | −86.54 | 14.2 | 3.35 | −23.42 |
| | 8 | 0.100 | −6.9 | 2.76 | −18.70 | 67.3 | −0.53 | −81.99 | 16.8 | 2.95 | −30.30 |
| | 9 | 0.114 | −4.8 | 2.38 | −30.23 | 66.4 | −1.66 | −75.17 | 19.0 | 2.48 | −33.55 |
| | 10 | 0.129 | −3.0 | 1.90 | −34.13 | 64.6 | −2.68 | −67.64 | 20.8 | 1.99 | −35.01 |
| | 11 | 0.143 | −1.7 | 1.41 | −32.12 | 62.0 | −3.60 | −60.31 | 22.2 | 1.48 | −35.53 |
| | 12 | 0.157 | −0.7 | 0.98 | −26.84 | 58.7 | −4.41 | −53.09 | 23.3 | 0.98 | −34.42 |
| | 13 | 0.172 | −0.1 | 0.64 | −20.23 | 54.8 | −5.11 | −45.78 | 23.8 | 0.50 | −30.99 |
| | 14 | 0.186 | 0.3 | 0.40 | −13.59 | 50.3 | −5.72 | −38.95 | 24.1 | 0.09 | −26.06 |
| | 15 | 0.200 | 0.6 | 0.25 | −8.03 | 45.4 | −6.23 | −32.91 | 24.0 | −0.25 | −21.52 |
| | 16 | 0.215 | 0.7 | 0.17 | −3.87 | 40.1 | −6.66 | −26.57 | 23.7 | −0.53 | −18.38 |
| | 17 | 0.229 | 0.9 | 0.14 | −0.56 | 34.5 | −6.99 | −18.05 | 23.1 | −0.77 | −16.10 |
| | 18 | 0.243 | 1.0 | 0.15 | 2.33 | 28.7 | −7.17 | −5.87 | 22.4 | −0.99 | −13.65 |
| | 19 | 0.257 | 1.1 | 0.21 | 4.60 | 22.8 | −7.16 | 10.65 | 21.5 | −1.16 | −10.37 |
| | 20 | 0.272 | 1.3 | 0.29 | 5.47 | 16.9 | −6.87 | 31.09 | 20.5 | −1.28 | −6.16 |
| | 21 | 0.286 | 1.6 | 0.36 | 3.83 | 11.5 | −6.27 | 53.59 | 19.4 | −1.34 | −1.66 |

*(continued)*

**TABLE A.4** *(Continued)*

| | | | ANKLE | | | KNEE | | | HIP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | THETA DEG | OMEGA R/S | ALPHA R/S/S | THETA DEG | OMEGA R/S | ALPHA R/S/S |
| | 22 | 0.300 | 1.9 | 0.40 | −0.84 | 6.7 | −5.34 | 74.76 | 18.3 | −1.33 | 1.98 |
| | 23 | 0.315 | 2.2 | 0.34 | −8.36 | 2.7 | −4.13 | 90.62 | 17.2 | −1.28 | 4.14 |
| | 24 | 0.329 | 2.5 | 0.16 | −19.22 | −0.1 | −2.75 | 97.96 | 16.2 | −1.21 | 5.38 |
| | 25 | 0.343 | 2.5 | −0.21 | −33.28 | −1.8 | −1.33 | 95.28 | 15.2 | −1.13 | 6.53 |
| | 26 | 0.357 | 2.1 | −0.79 | −46.39 | −2.3 | −0.02 | 82.64 | 14.3 | −1.03 | 7.45 |
| | 27 | 0.372 | 1.2 | −1.54 | −50.65 | −1.8 | 1.04 | 62.40 | 13.6 | −0.92 | 7.62 |
| HCR | 28 | 0.386 | −0.4 | −2.24 | −38.30 | −0.6 | 1.76 | 40.55 | 12.8 | −0.81 | 7.93 |
| | 29 | 0.400 | −2.5 | −2.63 | −7.99 | 1.1 | 2.20 | 24.37 | 12.2 | −0.69 | 9.91 |
| | 30 | 0.415 | −4.7 | −2.47 | 30.12 | 3.0 | 2.46 | 16.62 | 11.7 | −0.52 | 13.66 |
| | 31 | 0.429 | −6.5 | −1.77 | 59.60 | 5.1 | 2.67 | 12.93 | 11.4 | −0.30 | 16.99 |
| | 32 | 0.443 | −7.6 | −0.77 | 70.70 | 7.4 | 2.83 | 5.97 | 11.2 | −0.04 | 16.09 |
| | 33 | 0.458 | −7.8 | 0.25 | 64.54 | 9.8 | 2.84 | −8.17 | 11.3 | 0.16 | 7.69 |
| | 34 | 0.472 | −7.2 | 1.08 | 46.87 | 12.1 | 2.60 | −27.06 | 11.5 | 0.18 | −7.32 |
| | 35 | 0.486 | −6.0 | 1.59 | 24.33 | 14.0 | 2.07 | −44.04 | 11.6 | −0.05 | −22.88 |
| | 36 | 0.500 | −4.6 | 1.77 | 4.14 | 15.4 | 1.34 | −53.13 | 11.4 | −0.47 | −32.00 |
| | 37 | 0.515 | −3.1 | 1.71 | −8.73 | 16.2 | 0.55 | −52.57 | 10.8 | −0.96 | −31.67 |
| | 38 | 0.529 | −1.8 | 1.52 | −13.85 | 16.3 | −0.17 | −44.30 | 9.8 | −1.38 | −23.59 |
| | 39 | 0.543 | −0.6 | 1.31 | −13.32 | 15.9 | −0.72 | −31.51 | 8.6 | −1.64 | −11.54 |
| | 40 | 0.558 | 0.4 | 1.14 | −9.71 | 15.2 | −1.07 | −17.12 | 7.2 | −1.71 | 0.90 |
| | 41 | 0.572 | 1.2 | 1.04 | −6.42 | 14.2 | −1.21 | −3.98 | 5.8 | −1.61 | 10.98 |
| | 42 | 0.586 | 2.1 | 0.96 | −6.79 | 13.2 | −1.18 | 5.07 | 4.5 | −1.40 | 16.74 |
| | 43 | 0.601 | 2.8 | 0.84 | −10.34 | 12.3 | −1.06 | 8.50 | 3.5 | −1.13 | 17.58 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 44 | 0.615 | 3.4 | 0.66 | −12.36 | 11.4 | −0.94 | 7.49 | 2.7 | −0.89 | 15.03 |
| 45 | 0.629 | 3.9 | 0.49 | −9.52 | 10.7 | −0.85 | 4.99 | 2.0 | −0.70 | 11.60 |
| 46 | 0.643 | 4.2 | 0.39 | −3.26 | 10.1 | −0.80 | 3.03 | 1.5 | −0.56 | 8.39 |
| 47 | 0.658 | 4.6 | 0.40 | 3.33 | 9.4 | −0.76 | 1.90 | 1.1 | −0.46 | 4.74 |
| 48 | 0.672 | 4.9 | 0.49 | 7.14 | 8.8 | −0.74 | 1.14 | 0.8 | −0.43 | −0.13 |
| 49 | 0.686 | 5.3 | 0.60 | 4.92 | 8.2 | −0.73 | 0.45 | 0.4 | −0.47 | −5.26 |
| 50 | 0.701 | 5.9 | 0.63 | −3.15 | 7.6 | −0.73 | 0.18 | 0.0 | −0.58 | −8.17 |
| 51 | 0.715 | 6.4 | 0.51 | −11.50 | 7.0 | −0.72 | 1.21 | −0.5 | −0.70 | −7.39 |
| 52 | 0.729 | 6.7 | 0.30 | −14.34 | 6.4 | −0.69 | 4.06 | −1.2 | −0.79 | −4.00 |
| 53 | 0.744 | 6.9 | 0.10 | −10.68 | 5.9 | −0.61 | 8.77 | −1.8 | −0.81 | −0.17 |
| 54 | 0.758 | 6.9 | −0.01 | −4.17 | 5.4 | −0.44 | 15.06 | −2.5 | −0.79 | 3.12 |
| 55 | 0.772 | 6.9 | −0.02 | 0.00 | 5.2 | −0.18 | 22.07 | −3.1 | −0.73 | 5.70 |
| 56 | 0.786 | 6.8 | −0.01 | −1.14 | 5.1 | 0.19 | 28.41 | −3.7 | −0.63 | 6.92 |
| 57 | 0.801 | 6.8 | −0.05 | −7.42 | 5.5 | 0.63 | 32.98 | −4.2 | −0.53 | 6.16 |
| 58 | 0.815 | 6.8 | −0.22 | −17.46 | 6.2 | 1.13 | 35.54 | −4.6 | −0.45 | 3.95 |
| 59 | 0.829 | 6.5 | −0.55 | −28.75 | 7.3 | 1.65 | 36.64 | −4.9 | −0.41 | 1.81 |
| 60 | 0.844 | 5.9 | −1.04 | −37.44 | 8.9 | 2.18 | 37.19 | −5.2 | −0.40 | 1.24 |
| 61 | 0.858 | 4.8 | −1.62 | −40.93 | 10.9 | 2.71 | 37.90 | −5.6 | −0.38 | 2.74 |
| 62 | 0.872 | 3.2 | −2.21 | −40.94 | 13.3 | 3.26 | 39.00 | −5.9 | −0.32 | 5.62 |
| 63 | 0.887 | 1.2 | −2.79 | −41.67 | 16.2 | 3.83 | 40.04 | −6.1 | −0.22 | 8.61 |
| 64 | 0.901 | −1.4 | −3.40 | −43.21 | 19.6 | 4.41 | 39.95 | −6.2 | −0.08 | 11.23 |
| 65 | 0.915 | −4.4 | −4.03 | −38.18 | 23.5 | 4.97 | 37.59 | −6.2 | 0.10 | 14.31 |
| 66 | 0.929 | −8.0 | −4.50 | −17.72 | 27.8 | 5.48 | 32.25 | −6.0 | 0.33 | 18.85 |
| 67 | 0.944 | −11.8 | −4.54 | 18.41 | 32.4 | 5.90 | 23.44 | −5.7 | 0.64 | 24.81 |
| 68 | 0.958 | −15.4 | −3.97 | 59.42 | 37.4 | 6.15 | 10.87 | −5.0 | 1.04 | 31.17 |
| 69 | 0.972 | −18.3 | −2.84 | 91.15 | 42.5 | 6.21 | −4.80 | −4.0 | 1.53 | 36.24 |

*(continued)*

**TABLE A.4** *(Continued)*

| | | | ANKLE | | | KNEE | | | HIP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | FRAME | TIME S | THETA DEG | OMEGA R/S | ALPHA R/S/S | THETA DEG | OMEGA R/S | ALPHA R/S/S | THETA DEG | OMEGA R/S | ALPHA R/S/S |
| TOR | 70 | 0.987 | −20.1 | −1.36 | 104.21 | 47.6 | 6.02 | −21.92 | −2.5 | 2.08 | 38.01 |
| | 71 | 1.001 | −20.5 | 0.14 | 96.45 | 52.4 | 5.58 | −38.75 | −0.5 | 2.62 | 34.78 |
| | 72 | 1.015 | −19.8 | 1.40 | 72.74 | 56.7 | 4.91 | −53.72 | 1.8 | 3.07 | 26.42 |
| | 73 | 1.030 | −18.2 | 2.22 | 42.50 | 60.4 | 4.04 | −65.55 | 4.5 | 3.38 | 14.66 |
| | 74 | 1.044 | −16.2 | 2.61 | 15.01 | 63.4 | 3.03 | −74.32 | 7.3 | 3.49 | 1.29 |
| | 75 | 1.058 | −14.0 | 2.65 | −3.93 | 65.4 | 1.92 | −80.71 | 10.2 | 3.41 | −12.63 |
| | 76 | 1.072 | −11.8 | 2.50 | −13.24 | 66.5 | 0.73 | −83.96 | 12.9 | 3.13 | −25.25 |
| | 77 | 1.087 | −9.9 | 2.28 | −16.29 | 66.6 | −0.48 | −82.70 | 15.3 | 2.69 | −33.71 |
| | 78 | 1.101 | −8.1 | 2.03 | −17.51 | 65.7 | −1.64 | −76.99 | 17.3 | 2.17 | −36.16 |
| | 79 | 1.115 | −6.5 | 1.77 | −18.73 | 63.9 | −2.69 | −68.11 | 18.9 | 1.66 | −32.81 |
| | 80 | 1.130 | −5.2 | 1.50 | −19.65 | 61.3 | −3.59 | −57.74 | 20.1 | 1.23 | −25.82 |
| | 81 | 1.144 | −4.1 | 1.21 | −19.37 | 58.0 | −4.34 | −48.02 | 20.9 | 0.92 | −18.62 |
| | 82 | 1.158 | −3.2 | 0.94 | −17.21 | 54.2 | −4.96 | −40.91 | 21.6 | 0.70 | −14.21 |
| | 83 | 1.173 | −2.5 | 0.72 | −13.87 | 49.9 | −5.51 | −37.09 | 22.1 | 0.51 | −13.55 |
| | 84 | 1.187 | −2.0 | 0.55 | −10.79 | 45.2 | −6.02 | −35.35 | 22.4 | 0.31 | −15.62 |
| | 85 | 1.201 | −1.6 | 0.41 | −7.88 | 40.0 | −6.52 | −32.90 | 22.6 | 0.06 | −18.75 |
| | 86 | 1.215 | −1.3 | 0.32 | −3.38 | 34.5 | −6.96 | −26.57 | 22.5 | −0.23 | −21.73 |
| | 87 | 1.230 | −1.1 | 0.31 | 3.27 | 28.6 | −7.28 | −14.15 | 22.2 | −0.56 | −23.63 |
| | 88 | 1.244 | −0.8 | 0.42 | 9.14 | 22.6 | −7.37 | 4.76 | 21.6 | −0.90 | −23.22 |
| | 89 | 1.258 | −0.4 | 0.58 | 10.06 | 16.5 | −7.14 | 28.98 | 20.7 | −1.22 | −19.01 |
| | 90 | 1.273 | 0.1 | 0.70 | 4.80 | 10.9 | −6.54 | 56.01 | 19.6 | −1.45 | −10.61 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 91 | 1.287 | 0.7 | 0.71 | −4.67 | 5.8 | −5.54 | 81.46 | 18.3 | −1.52 | −0.51 |
| | 92 | 1.301 | 1.3 | 0.57 | −16.27 | 1.8 | −4.21 | 99.89 | 17.1 | −1.46 | 6.98 |
| | 93 | 1.316 | 1.7 | 0.25 | −29.67 | −1.1 | −2.68 | 107.07 | 15.9 | −1.32 | 9.49 |
| | 94 | 1.330 | 1.7 | −0.28 | −44.20 | −2.6 | −1.15 | 101.58 | 14.9 | −1.19 | 8.22 |
| | 95 | 1.344 | 1.2 | −1.02 | −54.99 | −3.0 | 0.22 | 85.39 | 14.0 | −1.09 | 6.14 |
| | 96 | 1.358 | 0.0 | −1.85 | −53.10 | −2.3 | 1.30 | 63.88 | 13.1 | −1.01 | 5.89 |
| HCR | 97 | 1.373 | −1.8 | −2.53 | −31.93 | −0.8 | 2.05 | 43.96 | 12.3 | −0.92 | 8.35 |
| | 98 | 1.387 | −4.1 | −2.77 | 4.96 | 1.1 | 2.55 | 29.90 | 11.6 | −0.78 | 12.18 |
| | 99 | 1.401 | −6.4 | −2.39 | 43.33 | 3.4 | 2.90 | 20.18 | 11.1 | −0.57 | 14.65 |
| | 100 | 1.416 | −8.0 | −1.53 | 67.62 | 5.9 | 3.13 | 9.21 | 10.7 | −0.36 | 13.20 |
| | 101 | 1.430 | −8.9 | −0.46 | 71.62 | 8.5 | 3.17 | −6.47 | 10.5 | −0.20 | 6.83 |
| | 102 | 1.444 | −8.8 | 0.52 | 59.88 | 11.0 | 2.94 | −24.49 | 10.4 | −0.16 | −2.99 |
| | 103 | 1.459 | −8.0 | 1.25 | 41.13 | 13.3 | 2.47 | −39.25 | 10.2 | −0.28 | −12.86 |
| | 104 | 1.473 | −6.7 | 1.70 | 22.10 | 15.1 | 1.82 | −46.90 | 9.9 | −0.53 | −19.17 |
| | 105 | 1.487 | −5.2 | 1.89 | 5.23 | 16.3 | 1.13 | −47.03 | 9.4 | −0.83 | −19.53 |
| | 106 | 1.501 | −3.7 | 1.85 | −10.10 | 16.9 | 0.48 | −40.67 | 8.5 | −1.09 | −13.02 |

**TABLE A.5(*a*) Reaction Forces and Moments of Force—Ankle and Knee**

| | | | FOOT SEGMENT | | | | | | LEG SEGMENT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GROUND | | ANKLE | | GROUND | ANKLE | ANKLE | | KNEE | | ANKLE | KNEE |
| | FRAME | TIME S | RX N | RY N | RX N | RY N | Cof P X M | MOMENT N.M | RX N | RY N | RX N | RY N | MOMENT N.M | MOMENT N.M |
| TOR | 1 | 0.000 | 0.0 | 0.0 | 20.9 | 3.9 | 0.000 | 1.6 | −20.9 | −3.9 | 52.0 | 31.6 | −1.6 | 7.0 |
| | 2 | 0.014 | 0.0 | 0.0 | 19.8 | 0.0 | 0.000 | 1.6 | −19.8 | 0.0 | 41.1 | 27.1 | −1.6 | 7.0 |
| | 3 | 0.029 | 0.0 | 0.0 | 17.6 | −3.1 | 0.000 | 1.5 | −17.6 | 3.1 | 30.8 | 22.2 | −1.5 | 6.9 |
| | 4 | 0.043 | 0.0 | 0.0 | 14.9 | −5.0 | 0.000 | 1.3 | −14.9 | 5.0 | 22.0 | 17.8 | −1.3 | 6.5 |
| | 5 | 0.057 | 0.0 | 0.0 | 12.3 | −5.5 | 0.000 | 1.1 | −12.3 | 5.5 | 15.1 | 14.6 | −1.1 | 5.8 |
| | 6 | 0.072 | 0.0 | 0.0 | 10.3 | −4.7 | 0.000 | 0.9 | −10.3 | 4.7 | 10.1 | 12.7 | −0.9 | 4.8 |
| | 7 | 0.086 | 0.0 | 0.0 | 8.6 | −3.0 | 0.000 | 0.7 | −8.6 | 3.0 | 6.5 | 12.2 | −0.7 | 3.6 |
| | 8 | 0.100 | 0.0 | 0.0 | 7.3 | −0.7 | 0.000 | 0.6 | −7.3 | 0.7 | 4.1 | 13.4 | −0.6 | 2.3 |
| | 9 | 0.114 | 0.0 | 0.0 | 6.3 | 2.0 | 0.000 | 0.5 | −6.3 | −2.0 | 2.5 | 15.9 | −0.5 | 1.0 |
| | 10 | 0.129 | 0.0 | 0.0 | 5.5 | 4.8 | 0.000 | 0.4 | −5.5 | −4.8 | 1.4 | 19.1 | −0.4 | −0.1 |
| | 11 | 0.143 | 0.0 | 0.0 | 4.7 | 7.5 | 0.000 | 0.4 | −4.7 | −7.5 | 0.4 | 22.8 | −0.4 | −1.0 |
| | 12 | 0.157 | 0.0 | 0.0 | 3.7 | 10.2 | 0.000 | 0.5 | −3.7 | −10.2 | −0.9 | 27.1 | −0.5 | −1.9 |
| | 13 | 0.172 | 0.0 | 0.0 | 2.5 | 12.6 | 0.000 | 0.5 | −2.5 | −12.6 | −2.8 | 31.8 | −0.5 | −2.7 |
| | 14 | 0.186 | 0.0 | 0.0 | 0.9 | 14.7 | 0.000 | 0.6 | −0.9 | −14.7 | −5.7 | 36.2 | −0.6 | −3.5 |
| | 15 | 0.200 | 0.0 | 0.0 | −0.9 | 16.1 | 0.000 | 0.6 | 0.9 | −16.1 | −9.5 | 39.6 | −0.6 | −4.2 |
| | 16 | 0.215 | 0.0 | 0.0 | −3.0 | 16.8 | 0.000 | 0.6 | 3.0 | −16.8 | −14.2 | 42.0 | −0.6 | −4.9 |
| | 17 | 0.229 | 0.0 | 0.0 | −5.4 | 17.0 | 0.000 | 0.6 | 5.4 | −17.0 | −19.7 | 43.4 | −0.6 | −5.8 |
| | 18 | 0.243 | 0.0 | 0.0 | −8.3 | 16.3 | 0.000 | 0.6 | 8.3 | −16.3 | −25.5 | 43.7 | −0.6 | −6.8 |
| | 19 | 0.257 | 0.0 | 0.0 | −11.5 | 14.8 | 0.000 | 0.5 | 11.5 | −14.8 | −30.7 | 42.7 | −0.5 | −8.0 |
| | 20 | 0.272 | 0.0 | 0.0 | −14.9 | 12.2 | 0.000 | 0.3 | 14.9 | −12.2 | −35.5 | 40.7 | −0.3 | −9.4 |
| | 21 | 0.286 | 0.0 | 0.0 | −18.1 | 9.0 | 0.000 | 0.1 | 18.1 | −9.0 | −39.9 | 38.2 | −0.1 | −11.1 |
| | 22 | 0.300 | 0.0 | 0.0 | −20.8 | 5.2 | 0.000 | −0.1 | 20.8 | −5.2 | −43.9 | 34.9 | 0.1 | −12.8 |
| | 23 | 0.315 | 0.0 | 0.0 | −22.7 | 1.6 | 0.000 | −0.3 | 22.7 | −1.6 | −46.6 | 30.6 | 0.3 | −14.3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24 | 0.329 | 0.0 | 0.0 | −23.2 | −1.2 | 0.000 | −0.5 | 23.2 | 1.2 | −47.3 | 26.1 | 0.5 | −15.1 |
| | 25 | 0.343 | 0.0 | 0.0 | −22.2 | −2.4 | 0.000 | −0.5 | 22.2 | 2.4 | −45.3 | 23.3 | 0.5 | −14.6 |
| | 26 | 0.357 | 0.0 | 0.0 | −19.5 | −1.7 | 0.000 | −0.5 | 19.5 | 1.7 | −40.6 | 24.1 | 0.5 | −12.7 |
| | 27 | 0.372 | 0.0 | 0.0 | −15.6 | 1.0 | 0.000 | −0.3 | 15.6 | −1.0 | −34.1 | 29.1 | 0.3 | −9.5 |
| HCR | 28 | 0.386 | 37.3 | 87.1 | −48.7 | −82.4 | 1.227 | −1.7 | 48.7 | 82.4 | −64.3 | −50.2 | 1.7 | −33.8 |
| | 29 | 0.400 | −4.2 | 192.6 | −3.8 | −184.1 | 1.244 | 4.6 | 3.8 | 184.1 | −16.8 | −148.2 | −4.6 | −19.9 |
| | 30 | 0.415 | −43.7 | 304.1 | 38.2 | −292.9 | 1.261 | 8.3 | −38.2 | 292.9 | 27.2 | −255.2 | −8.3 | −7.6 |
| | 31 | 0.429 | −74.0 | 404.2 | 69.8 | −391.4 | 1.291 | 2.8 | −69.8 | 391.4 | 59.9 | −354.6 | −2.8 | −4.5 |
| | 32 | 0.443 | −91.9 | 476.6 | 88.4 | −463.4 | 1.290 | 6.9 | −88.4 | 463.4 | 77.7 | −429.9 | −6.9 | 7.8 |
| | 33 | 0.458 | −102.7 | 521.7 | 99.7 | −508.9 | 1.301 | 4.6 | −99.7 | 508.9 | 86.3 | −480.2 | −4.6 | 14.5 |
| | 34 | 0.472 | −110.5 | 552.9 | 108.1 | −541.1 | 1.304 | 5.0 | −108.1 | 541.1 | 91.5 | −516.7 | −5.0 | 24.8 |
| | 35 | 0.486 | −114.2 | 579.8 | 112.5 | −569.0 | 1.311 | 2.6 | −112.5 | 569.0 | 94.3 | −547.2 | −2.6 | 31.6 |
| | 36 | 0.500 | −110.5 | 599.6 | 109.4 | −589.9 | 1.317 | −0.5 | −109.4 | 589.9 | 91.7 | −568.4 | 0.5 | 35.0 |
| | 37 | 0.515 | −98.1 | 604.5 | 97.1 | −595.7 | 1.316 | 0.2 | −97.1 | 595.7 | 80.9 | −573.4 | −0.2 | 37.8 |
| | 38 | 0.529 | −79.8 | 589.9 | 78.5 | −581.7 | 1.321 | −3.5 | −78.5 | 581.7 | 63.7 | −558.2 | 3.5 | 32.5 |
| | 39 | 0.543 | −62.0 | 558.1 | 60.3 | −550.2 | 1.322 | −5.1 | −60.3 | 550.2 | 47.2 | −525.1 | 5.1 | 28.1 |
| | 40 | 0.558 | −48.7 | 516.7 | 47.2 | −508.7 | 1.325 | −6.6 | −47.2 | 508.7 | 36.8 | −481.5 | 6.6 | 24.8 |
| | 41 | 0.572 | −39.8 | 473.4 | 38.8 | −465.3 | 1.333 | −10.5 | −38.8 | 465.3 | 32.2 | −436.1 | 10.5 | 20.2 |
| | 42 | 0.586 | −33.0 | 433.4 | 32.7 | −425.2 | 1.335 | −10.6 | −32.7 | 425.2 | 29.8 | −395.6 | 10.6 | 19.8 |
| | 43 | 0.601 | −27.0 | 400.3 | 27.2 | −392.2 | 1.345 | −14.1 | −27.2 | 392.2 | 27.4 | −364.4 | 14.1 | 15.8 |
| | 44 | 0.615 | −21.8 | 377.1 | 22.4 | −369.4 | 1.358 | −18.7 | −22.4 | 369.4 | 24.6 | −344.7 | 18.7 | 10.9 |
| | 45 | 0.629 | −18.1 | 365.0 | 19.0 | −357.6 | 1.369 | −22.5 | −19.0 | 357.6 | 22.3 | −335.4 | 22.5 | 7.8 |
| | 46 | 0.643 | −16.6 | 362.3 | 17.4 | −355.0 | 1.377 | −25.3 | −17.4 | 355.0 | 21.0 | −333.8 | 25.3 | 6.6 |
| | 47 | 0.658 | −16.8 | 366.5 | 17.6 | −359.1 | 1.384 | −27.9 | −17.6 | 359.1 | 21.0 | −337.2 | 27.9 | 6.6 |
| | 48 | 0.672 | −16.8 | 375.0 | 17.5 | −367.3 | 1.390 | −30.3 | −17.5 | 367.3 | 20.7 | −343.7 | 30.3 | 7.0 |
| | 49 | 0.686 | −14.5 | 386.1 | 15.2 | −378.2 | 1.396 | −33.5 | −15.2 | 378.2 | 18.3 | −352.3 | 33.5 | 5.9 |
| | 50 | 0.701 | −9.6 | 400.3 | 10.3 | −392.4 | 1.406 | −38.8 | −10.3 | 392.4 | 13.0 | −364.3 | 38.8 | 2.3 |
| | 51 | 0.715 | −3.8 | 418.8 | 4.2 | −410.8 | 1.417 | −45.1 | −4.2 | 410.8 | 6.0 | −381.2 | 45.1 | −2.3 |
| | 52 | 0.729 | 2.2 | 441.0 | −2.1 | −432.7 | 1.412 | −45.4 | 2.1 | 432.7 | −0.9 | −402.2 | 45.4 | −0.1 |
| | 53 | 0.744 | 8.7 | 465.8 | −9.0 | −457.0 | 1.424 | −53.5 | 9.0 | 457.0 | −6.8 | −426.3 | 53.5 | −5.0 |

*(continued)*

**TABLE A.5(*a*)** ***(Continued)***

| | | | FOOT SEGMENT | | | | | | LEG SEGMENT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GROUND | | ANKLE | | GROUND | ANKLE | ANKLE | | KNEE | | ANKLE | KNEE |
| | FRAME | TIME S | RX N | RY N | RX N | RY N | Cof P X M | MOMENT N.M | RX N | RY N | RX N | RY N | MOMENT N.M | MOMENT N.M |
| | 54 | 0.758 | 16.5 | 493.7 | −16.8 | −484.4 | 1.428 | −58.8 | 16.8 | 484.4 | −12.3 | −453.7 | 58.8 | −6.2 |
| | 55 | 0.772 | 26.8 | 523.9 | −27.1 | −514.2 | 1.432 | −64.8 | 27.1 | 514.2 | −19.7 | −483.6 | 64.8 | −7.9 |
| | 56 | 0.786 | 40.1 | 552.6 | −40.4 | −542.9 | 1.436 | −71.2 | 40.4 | 542.9 | −30.9 | −513.0 | 71.2 | −10.4 |
| | 57 | 0.801 | 54.8 | 576.8 | −55.0 | −567.5 | 1.440 | −77.3 | 55.0 | 567.5 | −43.5 | −538.7 | 77.3 | −12.5 |
| | 58 | 0.815 | 68.1 | 595.8 | −67.6 | −586.9 | 1.444 | −82.7 | 67.6 | 586.9 | −53.3 | −559.3 | 82.7 | −12.4 |
| | 59 | 0.829 | 79.6 | 608.6 | −77.9 | −599.7 | 1.447 | −87.0 | 77.9 | 599.7 | −59.1 | −573.0 | 87.0 | −10.0 |
| | 60 | 0.844 | 90.8 | 612.1 | −87.4 | −602.8 | 1.451 | −89.7 | 87.4 | 602.8 | −63.1 | −576.4 | 89.7 | −6.4 |
| | 61 | 0.858 | 101.5 | 602.3 | −96.4 | −592.2 | 1.455 | −89.8 | 96.4 | 592.2 | −66.5 | −566.1 | 89.8 | −2.2 |
| | 62 | 0.872 | 110.4 | 576.1 | −103.8 | −565.0 | 1.459 | −86.7 | 103.8 | 565.0 | −68.9 | −538.7 | 86.7 | 2.3 |
| | 63 | 0.887 | 115.6 | 530.3 | −107.7 | −518.2 | 1.463 | −79.7 | 107.7 | 518.2 | −69.7 | −491.1 | 79.7 | 6.5 |
| | 64 | 0.901 | 114.5 | 463.0 | −105.7 | −450.2 | 1.467 | −68.6 | 105.7 | 450.2 | −67.5 | −421.9 | 68.6 | 10.1 |
| | 65 | 0.915 | 105.2 | 377.3 | −95.5 | −364.4 | 1.470 | −54.3 | 95.5 | 364.4 | −60.1 | −335.2 | 54.3 | 12.5 |
| | 66 | 0.929 | 88.2 | 282.1 | −77.2 | −269.9 | 1.474 | −38.8 | 77.2 | 269.9 | −46.1 | −240.4 | 38.8 | 13.3 |
| | 67 | 0.944 | 65.7 | 190.1 | −53.0 | −179.1 | 1.478 | −24.2 | 53.0 | 179.1 | −26.4 | −149.3 | 24.2 | 12.5 |
| | 68 | 0.958 | 41.4 | 110.8 | −26.7 | −101.8 | 1.482 | −12.3 | 26.7 | 101.8 | −4.1 | −71.2 | 12.3 | 10.6 |
| | 69 | 0.972 | 18.4 | 44.4 | −2.1 | −37.9 | 1.486 | −3.6 | 2.1 | 37.9 | 16.9 | −6.8 | 3.6 | 6.8 |
| TOR | 70 | 0.987 | 0.0 | 0.0 | 17.1 | 3.5 | 0.000 | 1.4 | −17.1 | −3.5 | 32.9 | 34.3 | −1.4 | 3.6 |
| | 71 | 1.001 | 0.0 | 0.0 | 16.8 | 0.3 | 0.000 | 1.4 | −16.8 | −0.3 | 30.4 | 29.2 | −1.4 | 4.6 |
| | 72 | 1.015 | 0.0 | 0.0 | 15.8 | −2.5 | 0.000 | 1.4 | −15.8 | 2.5 | 28.0 | 23.0 | −1.4 | 5.7 |
| | 73 | 1.030 | 0.0 | 0.0 | 14.3 | −4.4 | 0.000 | 1.3 | −14.3 | 4.4 | 25.4 | 17.2 | −1.3 | 6.4 |
| | 74 | 1.044 | 0.0 | 0.0 | 12.6 | −4.9 | 0.000 | 1.1 | −12.6 | 4.9 | 22.1 | 13.4 | −1.1 | 6.3 |
| | 75 | 1.058 | 0.0 | 0.0 | 11.1 | −3.9 | 0.000 | 0.9 | −11.1 | 3.9 | 18.1 | 12.2 | −0.9 | 5.5 |
| | 76 | 1.072 | 0.0 | 0.0 | 9.7 | −2.0 | 0.000 | 0.7 | −9.7 | 2.0 | 14.0 | 12.8 | −0.7 | 4.3 |
| | 77 | 1.087 | 0.0 | 0.0 | 8.5 | 0.2 | 0.000 | 0.6 | −8.5 | −0.2 | 10.0 | 14.1 | −0.6 | 3.0 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 78 | 1.101 | 0.0 | 0.0 | 7.4 | 2.2 | 0.000 | 0.5 | −7.4 | −2.2 | 6.6 | 15.6 | −0.5 | 1.8 |
| | 79 | 1.115 | 0.0 | 0.0 | 6.3 | 4.3 | 0.000 | 0.5 | −6.3 | −4.3 | 3.7 | 17.8 | −0.5 | 0.6 |
| | 80 | 1.130 | 0.0 | 0.0 | 5.3 | 6.7 | 0.000 | 0.5 | −5.3 | −6.7 | 1.6 | 21.5 | −0.5 | −0.5 |
| | 81 | 1.144 | 0.0 | 0.0 | 4.3 | 9.2 | 0.000 | 0.5 | −4.3 | −9.2 | −0.2 | 25.9 | −0.5 | −1.5 |
| | 82 | 1.158 | 0.0 | 0.0 | 3.4 | 11.7 | 0.000 | 0.6 | −3.4 | −11.7 | −1.7 | 30.7 | −0.6 | −2.2 |
| | 83 | 1.173 | 0.0 | 0.0 | 2.4 | 14.1 | 0.000 | 0.6 | −2.4 | −14.1 | −3.5 | 35.5 | −0.6 | −2.7 |
| | 84 | 1.187 | 0.0 | 0.0 | 1.1 | 16.3 | 0.000 | 0.7 | −1.1 | −16.3 | −6.0 | 39.8 | −0.7 | −3.1 |
| | 85 | 1.201 | 0.0 | 0.0 | −0.9 | 17.8 | 0.000 | 0.8 | 0.9 | −17.8 | −9.8 | 43.0 | −0.8 | −3.6 |
| | 86 | 1.215 | 0.0 | 0.0 | −3.5 | 18.5 | 0.000 | 0.8 | 3.5 | −18.5 | −15.1 | 44.7 | −0.8 | −4.3 |
| | 87 | 1.230 | 0.0 | 0.0 | −6.8 | 18.0 | 0.000 | 0.7 | 6.8 | −18.0 | −21.7 | 45.3 | −0.7 | −5.6 |
| | 88 | 1.244 | 0.0 | 0.0 | −10.8 | 16.4 | 0.000 | 0.6 | 10.8 | −16.4 | −29.4 | 45.0 | −0.6 | −7.4 |
| | 89 | 1.258 | 0.0 | 0.0 | −15.3 | 13.6 | 0.000 | 0.4 | 15.3 | −13.6 | −37.5 | 43.5 | −0.4 | −9.7 |
| | 90 | 1.273 | 0.0 | 0.0 | −19.6 | 9.7 | 0.000 | 0.1 | 19.6 | −9.7 | −44.8 | 40.3 | −0.1 | −12.3 |
| | 91 | 1.287 | 0.0 | 0.0 | −23.1 | 5.3 | 0.000 | −0.2 | 23.1 | −5.3 | −49.6 | 36.0 | 0.2 | −14.5 |
| | 92 | 1.301 | 0.0 | 0.0 | −25.0 | 1.2 | 0.000 | −0.4 | 25.0 | −1.2 | −50.8 | 31.4 | 0.4 | −15.9 |
| | 93 | 1.316 | 0.0 | 0.0 | −24.9 | −1.8 | 0.000 | −0.5 | 24.9 | 1.8 | −48.4 | 27.6 | 0.5 | −15.9 |
| | 94 | 1.330 | 0.0 | 0.0 | −22.9 | −2.8 | 0.000 | −0.6 | 22.9 | 2.8 | −43.5 | 26.5 | 0.6 | −14.5 |
| | 95 | 1.344 | 0.0 | 0.0 | −19.4 | −1.6 | 0.000 | −0.5 | 19.4 | 1.6 | −36.8 | 29.0 | 0.5 | −11.7 |
| | 96 | 1.358 | 0.0 | 0.0 | −15.0 | 1.4 | 0.000 | −0.3 | 15.0 | −1.4 | −29.5 | 33.9 | 0.3 | −8.2 |
| HCR | 97 | 1.373 | 0.0 | 0.0 | −10.9 | 4.9 | 0.000 | 0.0 | 10.9 | −4.9 | −23.4 | 39.0 | 0.0 | −4.9 |
| | 98 | 1.387 | 0.0 | 0.0 | −8.1 | 8.2 | 0.000 | 0.3 | 8.1 | −8.2 | −19.9 | 42.8 | −0.3 | −2.8 |
| | 99 | 1.401 | 0.0 | 0.0 | −6.5 | 10.4 | 0.000 | 0.5 | 6.5 | −10.4 | −19.4 | 44.2 | −0.5 | −2.0 |
| | 100 | 1.416 | 0.0 | 0.0 | −5.9 | 11.6 | 0.000 | 0.6 | 5.9 | −11.6 | −21.4 | 42.9 | −0.6 | −2.4 |
| | 101 | 1.430 | 0.0 | 0.0 | −5.6 | 11.8 | 0.000 | 0.7 | 5.6 | −11.8 | −24.8 | 39.7 | −0.7 | −3.2 |
| | 102 | 1.444 | 0.0 | 0.0 | −5.2 | 11.4 | 0.000 | 0.7 | 5.2 | −11.4 | −28.4 | 36.1 | −0.7 | −4.1 |
| | 103 | 1.459 | 0.0 | 0.0 | −4.5 | 10.9 | 0.000 | 0.6 | 4.5 | −10.9 | −30.3 | 33.7 | −0.6 | −4.6 |
| | 104 | 1.473 | 0.0 | 0.0 | −3.4 | 10.4 | 0.000 | 0.6 | 3.4 | −10.4 | −28.9 | 33.1 | −0.6 | −4.2 |
| | 105 | 1.487 | 0.0 | 0.0 | −1.8 | 10.0 | 0.000 | 0.6 | 1.8 | −10.0 | −24.4 | 33.6 | −0.6 | −3.2 |
| | 106 | 1.501 | 0.0 | 0.0 | −0.4 | 9.5 | 0.000 | 0.6 | 0.4 | −9.5 | −19.0 | 34.0 | −0.6 | −2.1 |

**TABLE A.5(*b*) Reaction Forces and Moments of Force—Hip**

| | | | THIGH SEGMENT | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | KNEE | | HIP | | KNEE | HIP |
| | FRAME | TIME S | RX N | RY N | RX N | RY N | MOMENT N.M | MOMENT N.M |
| TOR | 1 | 0.000 | −52.0 | −31.6 | 59.7 | 112.1 | −7.0 | 22.9 |
| | 2 | 0.014 | −41.1 | −27.1 | 30.3 | 117.1 | −7.0 | 17.8 |
| | 3 | 0.029 | −30.8 | −22.2 | 9.1 | 116.7 | −6.9 | 13.8 |
| | 4 | 0.043 | −22.0 | −17.8 | −3.8 | 111.5 | −6.5 | 10.8 |
| | 5 | 0.057 | −15.1 | −14.6 | −9.4 | 102.8 | −5.8 | 8.5 |
| | 6 | 0.072 | −10.1 | −12.7 | −10.6 | 91.7 | −4.8 | 6.7 |
| | 7 | 0.086 | −6.5 | −12.2 | −10.0 | 80.4 | −3.6 | 5.0 |
| | 8 | 0.100 | −4.1 | −13.4 | −9.8 | 71.3 | −2.3 | 3.4 |
| | 9 | 0.114 | −2.5 | −15.9 | −10.4 | 65.0 | −1.0 | 2.0 |
| | 10 | 0.129 | −1.4 | −19.1 | −11.7 | 60.0 | 0.1 | 0.9 |
| | 11 | 0.143 | −0.4 | −22.8 | −13.3 | 56.1 | 1.0 | 0.0 |
| | 12 | 0.157 | 0.9 | −27.1 | −15.2 | 54.5 | 1.9 | −0.8 |
| | 13 | 0.172 | 2.8 | −31.8 | −18.1 | 55.5 | 2.7 | −1.5 |
| | 14 | 0.186 | 5.7 | −36.2 | −21.7 | 57.6 | 3.5 | −2.5 |
| | 15 | 0.200 | 9.5 | −39.6 | −25.3 | 59.9 | 4.2 | −3.6 |
| | 16 | 0.215 | 14.2 | −42.0 | −28.4 | 62.3 | 4.9 | −5.0 |
| | 17 | 0.229 | 19.7 | −43.4 | −31.3 | 65.1 | 5.8 | −6.7 |
| | 18 | 0.243 | 25.5 | −43.7 | −33.4 | 69.0 | 6.8 | −8.7 |
| | 19 | 0.257 | 30.7 | −42.7 | −33.9 | 74.4 | 8.0 | −10.5 |
| | 20 | 0.272 | 35.5 | −40.7 | −33.1 | 82.1 | 9.4 | −12.2 |
| | 21 | 0.286 | 39.9 | −38.2 | −32.1 | 91.9 | 11.1 | −14.0 |
| | 22 | 0.300 | 43.9 | −34.9 | −30.9 | 100.1 | 12.8 | −16.0 |
| | 23 | 0.315 | 46.6 | −30.6 | −29.4 | 103.1 | 14.3 | −17.9 |
| | 24 | 0.329 | 47.3 | −26.1 | −27.9 | 101.5 | 15.1 | −19.1 |
| | 25 | 0.343 | 45.3 | −23.3 | −26.8 | 99.4 | 14.6 | −18.7 |
| | 26 | 0.357 | 40.6 | −24.1 | −26.5 | 100.7 | 12.7 | −16.1 |
| | 27 | 0.372 | 34.1 | −29.1 | −27.3 | 106.9 | 9.5 | −11.7 |
| HCR | 28 | 0.386 | 64.3 | 50.2 | −66.1 | 29.7 | 33.8 | −54.4 |
| | 29 | 0.400 | 16.8 | 148.2 | −26.3 | −66.4 | 19.9 | −37.6 |
| | 30 | 0.415 | −27.2 | 255.2 | 12.4 | −173.3 | 7.6 | −23.5 |
| | 31 | 0.429 | −59.9 | 354.6 | 41.3 | −276.1 | 4.5 | −20.8 |
| | 32 | 0.443 | −77.7 | 429.9 | 54.7 | −359.4 | −7.8 | −11.1 |
| | 33 | 0.458 | −86.3 | 480.2 | 58.3 | −421.0 | −14.5 | −7.8 |
| | 34 | 0.472 | −91.5 | 516.7 | 60.4 | −468.3 | −24.8 | −0.4 |
| | 35 | 0.486 | −94.3 | 547.2 | 63.8 | −504.4 | −31.6 | 4.7 |
| | 36 | 0.500 | −91.7 | 568.4 | 64.2 | −526.0 | −35.0 | 7.3 |
| | 37 | 0.515 | −80.9 | 573.4 | 55.7 | −529.1 | −37.8 | 9.9 |
| | 38 | 0.529 | −63.7 | 558.2 | 39.0 | −512.7 | −32.5 | 5.0 |
| | 39 | 0.543 | −47.2 | 525.1 | 22.5 | −478.1 | −28.1 | 3.0 |
| | 40 | 0.558 | −36.8 | 481.5 | 13.4 | −431.6 | −24.8 | 4.7 |
| | 41 | 0.572 | −32.2 | 436.1 | 12.3 | −383.0 | −20.2 | 6.5 |
| | 42 | 0.586 | −29.8 | 395.6 | 15.2 | −341.7 | −19.8 | 12.0 |

**TABLE A.5(*b*)** ***(Continued)***

| | | | THIGH SEGMENT | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | KNEE | | HIP | | KNEE | HIP |
| | FRAME | TIME S | RX N | RY N | RX N | RY N | MOMENT N.M | MOMENT N.M |
| | 43 | 0.601 | −27.4 | 364.4 | 18.7 | −314.3 | −15.8 | 12.5 |
| | 44 | 0.615 | −24.6 | 344.7 | 21.0 | −301.1 | −10.9 | 10.9 |
| | 45 | 0.629 | −22.3 | 335.4 | 21.9 | −296.7 | −7.8 | 10.1 |
| | 46 | 0.643 | −21.0 | 333.8 | 22.5 | −295.3 | −6.6 | 11.2 |
| | 47 | 0.658 | −21.0 | 337.2 | 24.4 | −295.0 | −6.6 | 13.8 |
| | 48 | 0.672 | −20.7 | 343.7 | 27.3 | −296.3 | −7.0 | 16.7 |
| | 49 | 0.686 | −18.3 | 352.3 | 27.9 | −300.2 | −5.9 | 17.7 |
| | 50 | 0.701 | −13.0 | 364.3 | 23.4 | −308.6 | −2.3 | 15.2 |
| | 51 | 0.715 | −6.0 | 381.2 | 14.5 | −323.0 | 2.3 | 11.2 |
| | 52 | 0.729 | 0.9 | 402.2 | 5.7 | −342.8 | 0.1 | 14.6 |
| | 53 | 0.744 | 6.8 | 426.3 | 1.0 | −366.2 | 5.0 | 12.2 |
| | 54 | 0.758 | 12.3 | 453.7 | 0.1 | −393.6 | 6.2 | 14.7 |
| | 55 | 0.772 | 19.7 | 483.6 | −2.5 | −424.7 | 7.9 | 16.6 |
| | 56 | 0.786 | 30.9 | 513.0 | −10.6 | −456.2 | 10.4 | 16.5 |
| | 57 | 0.801 | 43.5 | 538.7 | −20.3 | −484.2 | 12.5 | 16.1 |
| | 58 | 0.815 | 53.3 | 559.3 | −24.8 | −506.3 | 12.4 | 18.3 |
| | 59 | 0.829 | 59.1 | 573.0 | −22.7 | −521.5 | 10.0 | 23.6 |
| | 60 | 0.844 | 63.1 | 576.4 | −17.8 | −527.1 | 6.4 | 29.5 |
| | 61 | 0.858 | 66.5 | 566.1 | −13.2 | −519.0 | 2.2 | 34.4 |
| | 62 | 0.872 | 68.9 | 538.7 | −10.1 | −492.1 | −2.3 | 37.3 |
| | 63 | 0.887 | 69.7 | 491.1 | −10.7 | −442.7 | −6.5 | 37.2 |
| | 64 | 0.901 | 67.5 | 421.9 | −16.0 | −370.1 | −10.1 | 33.6 |
| | 65 | 0.915 | 60.1 | 335.2 | −23.2 | −279.2 | −12.5 | 27.5 |
| | 66 | 0.929 | 46.1 | 240.4 | −27.5 | −179.5 | −13.3 | 20.7 |
| | 67 | 0.944 | 26.4 | 149.3 | −25.0 | −82.3 | −12.5 | 15.2 |
| | 68 | 0.958 | 4.1 | 71.2 | −16.0 | 2.9 | −10.6 | 11.9 |
| | 69 | 0.972 | −16.9 | 6.8 | −3.5 | 74.9 | −6.8 | 9.3 |
| TOR | 70 | 0.987 | −32.9 | −34.3 | 8.9 | 122.0 | −3.6 | 9.0 |
| | 71 | 1.001 | −30.4 | −29.2 | 7.9 | 120.0 | −4.6 | 10.4 |
| | 72 | 1.015 | −28.0 | −23.0 | 10.7 | 113.5 | −5.7 | 12.3 |
| | 73 | 1.030 | −25.4 | −17.2 | 14.0 | 104.6 | −6.4 | 13.6 |
| | 74 | 1.044 | −22.1 | −13.4 | 14.8 | 96.0 | −6.3 | 13.4 |
| | 75 | 1.058 | −18.1 | −12.2 | 12.8 | 88.5 | −5.5 | 11.8 |
| | 76 | 1.072 | −14.0 | −12.8 | 9.0 | 80.7 | −4.3 | 9.4 |
| | 77 | 1.087 | −10.0 | −14.1 | 3.9 | 71.1 | −3.0 | 6.8 |
| | 78 | 1.101 | −6.6 | −15.6 | −2.0 | 61.1 | −1.8 | 4.2 |
| | 79 | 1.115 | −3.7 | −17.8 | −8.0 | 54.2 | −0.6 | 2.0 |
| | 80 | 1.130 | −1.6 | −21.5 | −13.8 | 51.8 | 0.5 | 0.4 |
| | 81 | 1.144 | 0.2 | −25.9 | −18.9 | 53.0 | 1.5 | −0.7 |
| | 82 | 1.158 | 1.7 | −30.7 | −22.8 | 55.8 | 2.2 | −1.4 |
| | 83 | 1.173 | 3.5 | −35.5 | −25.5 | 59.1 | 2.7 | −1.7 |
| | 84 | 1.187 | 6.0 | −39.8 | −27.3 | 62.0 | 3.1 | −2.1 |

*(continued)*

**TABLE A.5(*b*)** ***(Continued)***

| | | | THIGH SEGMENT | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | KNEE | | HIP | | KNEE | HIP |
| | FRAME | TIME S | RX N | RY N | RX N | RY N | MOMENT N.M | MOMENT N.M |
| | 85 | 1.201 | 9.8 | −43.0 | −28.9 | 63.7 | 3.6 | −3.0 |
| | 86 | 1.215 | 15.1 | −44.7 | −30.5 | 65.2 | 4.3 | −4.5 |
| | 87 | 1.230 | 21.7 | −45.3 | −31.7 | 68.8 | 5.6 | −6.7 |
| | 88 | 1.244 | 29.4 | −45.0 | −32.7 | 75.5 | 7.4 | −9.4 |
| | 89 | 1.258 | 37.5 | −43.5 | −34.2 | 83.8 | 9.7 | −12.8 |
| | 90 | 1.273 | 44.8 | −40.3 | −35.7 | 92.0 | 12.3 | −16.4 |
| | 91 | 1.287 | 49.6 | −36.0 | −34.2 | 99.0 | 14.5 | −19.0 |
| | 92 | 1.301 | 50.8 | −31.4 | −28.5 | 104.4 | 15.9 | −19.7 |
| | 93 | 1.316 | 48.4 | −27.6 | −20.9 | 108.1 | 15.9 | −18.6 |
| | 94 | 1.330 | 43.5 | −26.5 | −14.9 | 111.6 | 14.5 | −15.7 |
| | 95 | 1.344 | 36.8 | −29.0 | −12.5 | 115.8 | 11.7 | −11.5 |
| | 96 | 1.358 | 29.5 | −33.9 | −14.1 | 119.7 | 8.2 | −6.7 |
| HCR | 97 | 1.373 | 23.4 | −39.0 | −19.4 | 122.3 | 4.9 | −2.9 |
| | 98 | 1.387 | 19.9 | −42.8 | −27.3 | 123.5 | 2.8 | −1.0 |
| | 99 | 1.401 | 19.4 | −44.2 | −36.7 | 121.9 | 2.0 | −1.4 |
| | 100 | 1.416 | 21.4 | −42.9 | −47.1 | 115.1 | 2.4 | −3.9 |
| | 101 | 1.430 | 24.8 | −39.7 | −58.3 | 103.2 | 3.2 | −7.8 |
| | 102 | 1.444 | 28.4 | −36.1 | −68.8 | 89.8 | 4.1 | −12.0 |
| | 103 | 1.459 | 30.3 | −33.7 | −75.7 | 80.0 | 4.6 | −14.7 |
| | 104 | 1.473 | 28.9 | −33.1 | −76.9 | 76.4 | 4.2 | −14.9 |
| | 105 | 1.487 | 24.4 | −33.6 | −73.9 | 77.2 | 3.2 | −12.8 |
| | 106 | 1.501 | 19.0 | −34.0 | −72.3 | 78.9 | 2.1 | −10.4 |

**TABLE A.6 Segment Potential, Kinetic, and Total Energies—Foot, Leg, Thigh, and ½ HAT**

| | | FOOT SEGMENT | | | | LEG SEGMENT | | | | THIGH SEGMENT | | | | H.A.T. SEGMENT | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FRAME | TIME S | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J |
| 1 | 0.000 | 1.2 | 1.8 | 0.0 | 3.0 | 9.5 | 8.3 | 0.1 | 17.9 | 36.3 | 12.3 | 0.3 | 48.8 | 203.6 | 18.2 | 0.4 | 222.3 |
| 2 | 0.014 | 1.3 | 2.3 | 0.0 | 3.6 | 9.6 | 9.2 | 0.1 | 18.9 | 36.2 | 12.2 | 0.3 | 48.8 | 203.8 | 18.3 | 0.3 | 222.4 |
| 3 | 0.029 | 1.4 | 2.9 | 0.0 | 4.3 | 9.7 | 9.9 | 0.0 | 19.6 | 36.3 | 11.7 | 0.4 | 48.4 | 204.1 | 17.9 | 0.1 | 222.1 |
| 4 | 0.043 | 1.4 | 3.5 | 0.0 | 4.9 | 9.8 | 10.2 | 0.0 | 20.0 | 36.4 | 11.1 | 0.4 | 47.9 | 204.6 | 17.2 | 0.1 | 221.8 |
| 5 | 0.057 | 1.4 | 4.0 | 0.0 | 5.5 | 9.9 | 10.4 | 0.0 | 20.3 | 36.7 | 10.5 | 0.4 | 47.6 | 205.2 | 16.3 | 0.0 | 221.6 |
| 6 | 0.072 | 1.4 | 4.6 | 0.0 | 6.0 | 10.0 | 10.4 | 0.1 | 20.5 | 36.9 | 10.0 | 0.4 | 47.4 | 206.0 | 15.6 | 0.0 | 221.7 |
| 7 | 0.086 | 1.4 | 5.1 | 0.0 | 6.5 | 10.0 | 10.3 | 0.2 | 20.5 | 37.3 | 9.6 | 0.4 | 47.3 | 207.0 | 15.1 | 0.1 | 222.1 |
| 8 | 0.100 | 1.3 | 5.5 | 0.1 | 6.9 | 10.1 | 10.2 | 0.3 | 20.5 | 37.6 | 9.3 | 0.3 | 47.2 | 207.9 | 14.8 | 0.1 | 222.8 |
| 9 | 0.114 | 1.3 | 6.0 | 0.1 | 7.3 | 10.1 | 10.1 | 0.3 | 20.5 | 38.0 | 9.0 | 0.2 | 47.2 | 208.9 | 14.6 | 0.1 | 223.6 |
| 10 | 0.129 | 1.2 | 6.3 | 0.1 | 7.6 | 10.1 | 9.9 | 0.4 | 20.4 | 38.3 | 8.6 | 0.2 | 47.1 | 209.8 | 14.4 | 0.2 | 224.3 |
| 11 | 0.143 | 1.1 | 6.6 | 0.1 | 7.8 | 10.1 | 9.8 | 0.5 | 20.3 | 38.7 | 8.2 | 0.1 | 47.0 | 210.6 | 14.1 | 0.2 | 224.9 |
| 12 | 0.157 | 1.0 | 6.9 | 0.1 | 8.0 | 10.0 | 9.6 | 0.5 | 20.2 | 38.9 | 7.7 | 0.1 | 46.7 | 211.2 | 13.9 | 0.3 | 225.4 |
| 13 | 0.172 | 0.9 | 7.0 | 0.1 | 8.0 | 9.9 | 9.4 | 0.6 | 20.0 | 39.1 | 7.3 | 0.0 | 46.5 | 211.6 | 13.7 | 0.4 | 225.7 |
| 14 | 0.186 | 0.8 | 7.1 | 0.1 | 8.0 | 9.9 | 9.2 | 0.6 | 19.7 | 39.3 | 6.8 | 0.0 | 46.1 | 211.9 | 13.7 | 0.4 | 225.9 |
| 15 | 0.200 | 0.8 | 7.0 | 0.1 | 7.9 | 9.8 | 9.0 | 0.6 | 19.4 | 39.4 | 6.4 | 0.0 | 45.8 | 212.0 | 13.9 | 0.4 | 226.2 |
| 16 | 0.215 | 0.7 | 6.9 | 0.1 | 7.7 | 9.7 | 8.6 | 0.6 | 18.9 | 39.4 | 6.1 | 0.0 | 45.5 | 211.9 | 14.4 | 0.3 | 226.6 |
| 17 | 0.229 | 0.7 | 6.6 | 0.1 | 7.4 | 9.6 | 8.2 | 0.6 | 18.3 | 39.3 | 5.9 | 0.0 | 45.2 | 211.6 | 15.4 | 0.2 | 227.2 |
| 18 | 0.243 | 0.7 | 6.2 | 0.1 | 7.0 | 9.5 | 7.6 | 0.6 | 17.7 | 39.2 | 5.7 | 0.0 | 44.9 | 211.1 | 16.7 | 0.2 | 227.9 |
| 19 | 0.257 | 0.7 | 5.7 | 0.1 | 6.5 | 9.4 | 7.0 | 0.5 | 16.9 | 39.0 | 5.7 | 0.0 | 44.7 | 210.5 | 18.1 | 0.1 | 228.7 |
| 20 | 0.272 | 0.8 | 5.0 | 0.1 | 5.8 | 9.3 | 6.4 | 0.5 | 16.1 | 38.7 | 5.8 | 0.0 | 44.6 | 209.7 | 19.6 | 0.1 | 229.4 |
| 21 | 0.286 | 0.8 | 4.2 | 0.0 | 5.0 | 9.2 | 5.7 | 0.4 | 15.3 | 38.5 | 5.9 | 0.0 | 44.4 | 208.9 | 20.8 | 0.1 | 229.7 |

*(continued)*

**TABLE A.6** *(Continued)*

| | | FOOT SEGMENT | | | | LEG SEGMENT | | | | THIGH SEGMENT | | | | H.A.T. SEGMENT | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FRAME | TIME S | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J |
| 22 | 0.300 | 0.8 | 3.3 | 0.0 | 4.2 | 9.1 | 5.1 | 0.3 | 14.4 | 38.2 | 6.1 | 0.0 | 44.3 | 208.1 | 21.5 | 0.0 | 229.7 |
| 23 | 0.315 | 0.9 | 2.5 | 0.0 | 3.4 | 9.0 | 4.4 | 0.1 | 13.6 | 37.9 | 6.4 | 0.0 | 44.3 | 207.4 | 21.9 | 0.1 | 229.3 |
| 24 | 0.329 | 0.9 | 1.7 | 0.0 | 2.6 | 9.0 | 3.8 | 0.1 | 12.8 | 37.7 | 6.7 | 0.0 | 44.4 | 206.7 | 22.0 | 0.1 | 228.8 |
| 25 | 0.343 | 0.9 | 1.1 | 0.0 | 2.0 | 8.9 | 3.3 | 0.0 | 12.2 | 37.5 | 7.1 | 0.0 | 44.6 | 206.1 | 22.1 | 0.1 | 228.4 |
| 26 | 0.357 | 0.9 | 0.7 | 0.0 | 1.5 | 8.8 | 2.8 | 0.0 | 11.6 | 37.4 | 7.4 | 0.0 | 44.8 | 205.7 | 22.5 | 0.1 | 228.3 |
| 27 | 0.372 | 0.8 | 0.4 | 0.0 | 1.3 | 8.8 | 2.4 | 0.0 | 11.2 | 37.3 | 7.6 | 0.0 | 44.9 | 205.3 | 23.1 | 0.1 | 228.6 |
| 28 | 0.386 | 0.8 | 0.3 | 0.0 | 1.1 | 8.7 | 2.1 | 0.1 | 10.8 | 37.2 | 7.7 | 0.0 | 44.9 | 205.1 | 23.9 | 0.1 | 229.2 |
| 29 | 0.400 | 0.7 | 0.2 | 0.0 | 1.0 | 8.6 | 1.8 | 0.1 | 10.5 | 37.2 | 7.5 | 0.0 | 44.8 | 205.1 | 24.7 | 0.0 | 229.8 |
| 30 | 0.415 | 0.7 | 0.2 | 0.0 | 0.9 | 8.6 | 1.6 | 0.1 | 10.3 | 37.3 | 7.3 | 0.0 | 44.5 | 205.3 | 25.2 | 0.0 | 230.5 |
| 31 | 0.429 | 0.6 | 0.1 | 0.0 | 0.7 | 8.6 | 1.4 | 0.1 | 10.2 | 37.4 | 6.9 | 0.0 | 44.3 | 205.7 | 25.5 | 0.0 | 231.1 |
| 32 | 0.443 | 0.6 | 0.1 | 0.0 | 0.7 | 8.6 | 1.3 | 0.1 | 10.0 | 37.5 | 6.5 | 0.0 | 44.1 | 206.3 | 25.4 | 0.0 | 231.7 |
| 33 | 0.458 | 0.5 | 0.0 | 0.0 | 0.6 | 8.6 | 1.2 | 0.1 | 9.9 | 37.7 | 6.0 | 0.0 | 43.8 | 207.0 | 25.0 | 0.1 | 232.1 |
| 34 | 0.472 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 1.0 | 0.1 | 9.8 | 37.9 | 5.4 | 0.0 | 43.3 | 207.8 | 24.2 | 0.2 | 232.2 |
| 35 | 0.486 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.8 | 0.1 | 9.6 | 38.1 | 4.8 | 0.0 | 42.9 | 208.6 | 23.2 | 0.2 | 232.0 |
| 36 | 0.500 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.6 | 0.1 | 9.4 | 38.2 | 4.2 | 0.0 | 42.5 | 209.3 | 22.2 | 0.2 | 231.7 |
| 37 | 0.515 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.4 | 0.1 | 9.2 | 38.4 | 3.8 | 0.1 | 42.2 | 209.9 | 21.3 | 0.1 | 231.3 |
| 38 | 0.529 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.3 | 0.0 | 9.1 | 38.4 | 3.3 | 0.1 | 41.9 | 210.5 | 20.3 | 0.1 | 230.9 |
| 39 | 0.543 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.2 | 0.0 | 9.0 | 38.5 | 3.0 | 0.1 | 41.6 | 211.0 | 19.4 | 0.1 | 230.5 |
| 40 | 0.558 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.1 | 0.0 | 8.9 | 38.6 | 2.6 | 0.1 | 41.3 | 211.5 | 18.6 | 0.1 | 230.2 |
| 41 | 0.572 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.1 | 0.0 | 8.9 | 38.6 | 2.3 | 0.1 | 41.1 | 211.8 | 18.1 | 0.2 | 230.1 |
| 42 | 0.586 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.1 | 0.0 | 8.8 | 38.7 | 2.1 | 0.1 | 40.9 | 212.1 | 17.8 | 0.3 | 230.2 |
| 43 | 0.601 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.1 | 0.0 | 8.9 | 38.7 | 1.9 | 0.1 | 40.8 | 212.4 | 17.7 | 0.4 | 230.4 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | 0.615 | 0.5 | 0.0 | 0.0 | 0.5 | 8.8 | 0.1 | 0.0 | 8.9 | 38.7 | 1.9 | 0.1 | 40.7 | 212.6 | 17.7 | 0.5 | 230.8 |
| 45 | 0.629 | 0.5 | 0.0 | 0.0 | 0.5 | 8.8 | 0.1 | 0.0 | 8.9 | 38.7 | 1.9 | 0.1 | 40.7 | 212.6 | 17.9 | 0.6 | 231.1 |
| 46 | 0.643 | 0.5 | 0.0 | 0.0 | 0.5 | 8.8 | 0.1 | 0.0 | 8.9 | 38.7 | 1.9 | 0.1 | 40.7 | 212.5 | 18.3 | 0.7 | 231.5 |
| 47 | 0.658 | 0.5 | 0.0 | 0.0 | 0.5 | 8.8 | 0.1 | 0.0 | 8.9 | 38.6 | 1.9 | 0.1 | 40.6 | 212.3 | 18.7 | 0.7 | 231.7 |
| 48 | 0.672 | 0.5 | 0.0 | 0.0 | 0.5 | 8.8 | 0.2 | 0.0 | 8.9 | 38.6 | 2.0 | 0.1 | 40.6 | 211.9 | 19.2 | 0.8 | 231.9 |
| 49 | 0.686 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.2 | 0.0 | 8.9 | 38.4 | 2.1 | 0.1 | 40.6 | 211.5 | 19.7 | 0.7 | 231.9 |
| 50 | 0.701 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.2 | 0.0 | 8.9 | 38.3 | 2.2 | 0.1 | 40.6 | 211.0 | 20.2 | 0.6 | 231.8 |
| 51 | 0.715 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.2 | 0.0 | 8.9 | 38.2 | 2.4 | 0.1 | 40.7 | 210.4 | 20.5 | 0.6 | 231.5 |
| 52 | 0.729 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.2 | 0.0 | 8.9 | 38.1 | 2.5 | 0.1 | 40.6 | 209.9 | 20.7 | 0.5 | 231.1 |
| 53 | 0.744 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.2 | 0.0 | 8.9 | 38.0 | 2.5 | 0.1 | 40.6 | 209.3 | 20.9 | 0.5 | 230.7 |
| 54 | 0.758 | 0.5 | 0.0 | 0.0 | 0.5 | 8.7 | 0.2 | 0.0 | 8.9 | 37.9 | 2.6 | 0.1 | 40.6 | 208.7 | 21.3 | 0.5 | 230.5 |
| 55 | 0.772 | 0.5 | 0.0 | 0.0 | 0.6 | 8.7 | 0.3 | 0.0 | 9.0 | 37.8 | 2.9 | 0.1 | 40.7 | 208.1 | 21.7 | 0.5 | 230.2 |
| 56 | 0.786 | 0.6 | 0.0 | 0.0 | 0.6 | 8.7 | 0.3 | 0.1 | 9.1 | 37.7 | 3.1 | 0.1 | 40.9 | 207.6 | 21.9 | 0.4 | 229.9 |
| 57 | 0.801 | 0.6 | 0.0 | 0.0 | 0.6 | 8.8 | 0.4 | 0.1 | 9.2 | 37.7 | 3.5 | 0.0 | 41.2 | 207.1 | 22.0 | 0.3 | 229.3 |
| 58 | 0.815 | 0.6 | 0.0 | 0.0 | 0.6 | 8.8 | 0.5 | 0.1 | 9.4 | 37.6 | 3.9 | 0.0 | 41.5 | 206.5 | 21.9 | 0.2 | 228.6 |
| 59 | 0.829 | 0.6 | 0.0 | 0.0 | 0.6 | 8.8 | 0.7 | 0.1 | 9.6 | 37.5 | 4.4 | 0.0 | 41.9 | 206.1 | 21.9 | 0.1 | 228.1 |
| 60 | 0.844 | 0.6 | 0.0 | 0.0 | 0.7 | 8.9 | 0.9 | 0.1 | 9.9 | 37.4 | 5.2 | 0.0 | 42.6 | 205.6 | 22.3 | 0.0 | 227.9 |
| 61 | 0.858 | 0.7 | 0.0 | 0.0 | 0.7 | 8.9 | 1.3 | 0.1 | 10.3 | 37.3 | 6.2 | 0.0 | 43.5 | 205.2 | 23.1 | 0.0 | 228.3 |
| 62 | 0.872 | 0.7 | 0.1 | 0.0 | 0.8 | 9.0 | 1.7 | 0.2 | 10.9 | 37.2 | 7.5 | 0.0 | 44.7 | 204.8 | 24.4 | 0.0 | 229.3 |
| 63 | 0.887 | 0.7 | 0.1 | 0.1 | 0.9 | 9.0 | 2.4 | 0.2 | 11.6 | 37.1 | 9.0 | 0.0 | 46.0 | 204.5 | 25.8 | 0.1 | 230.4 |
| 64 | 0.901 | 0.8 | 0.2 | 0.1 | 1.1 | 9.1 | 3.2 | 0.2 | 12.5 | 36.9 | 10.5 | 0.0 | 47.4 | 204.1 | 26.7 | 0.2 | 231.1 |
| 65 | 0.915 | 0.8 | 0.3 | 0.1 | 1.2 | 9.1 | 4.1 | 0.2 | 13.4 | 36.7 | 11.8 | 0.0 | 48.5 | 203.8 | 26.5 | 0.4 | 230.7 |
| 66 | 0.929 | 0.9 | 0.5 | 0.1 | 1.5 | 9.2 | 5.0 | 0.2 | 14.3 | 36.6 | 12.6 | 0.1 | 49.2 | 203.6 | 24.9 | 0.6 | 229.1 |
| 67 | 0.944 | 1.0 | 0.7 | 0.1 | 1.8 | 9.2 | 5.8 | 0.2 | 15.2 | 36.4 | 12.9 | 0.1 | 49.4 | 203.4 | 22.3 | 0.8 | 226.5 |
| 68 | 0.958 | 1.1 | 1.0 | 0.1 | 2.1 | 9.3 | 6.6 | 0.1 | 16.0 | 36.3 | 12.6 | 0.1 | 49.1 | 203.2 | 19.6 | 0.8 | 223.7 |
| 69 | 0.972 | 1.1 | 1.3 | 0.0 | 2.5 | 9.4 | 7.3 | 0.1 | 16.7 | 36.2 | 12.1 | 0.2 | 48.5 | 203.2 | 17.4 | 0.7 | 221.3 |

*(continued)*

**TABLE A.6** *(Continued)*

| | | FOOT SEGMENT | | | | LEG SEGMENT | | | | THIGH SEGMENT | | | | H.A.T. SEGMENT | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FRAME | TIME S | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J | PE J | TKE J | RKE J | TOTAL J |
| 70 | 0.987 | 1.2 | 1.7 | 0.0 | 3.0 | 9.5 | 7.9 | 0.1 | 17.4 | 36.1 | 11.4 | 0.3 | 47.8 | 203.3 | 15.8 | 0.5 | 219.7 |
| 71 | 1.001 | 1.3 | 2.2 | 0.0 | 3.5 | 9.6 | 8.4 | 0.0 | 18.0 | 36.2 | 10.7 | 0.3 | 47.2 | 203.5 | 14.9 | 0.3 | 218.7 |
| 72 | 1.015 | 1.4 | 2.7 | 0.0 | 4.1 | 9.7 | 8.8 | 0.0 | 18.5 | 36.3 | 10.2 | 0.4 | 46.8 | 203.9 | 14.4 | 0.2 | 218.5 |
| 73 | 1.030 | 1.4 | 3.3 | 0.0 | 4.7 | 9.8 | 9.3 | 0.0 | 19.1 | 36.4 | 9.9 | 0.4 | 46.8 | 204.5 | 14.3 | 0.1 | 218.9 |
| 74 | 1.044 | 1.4 | 3.8 | 0.0 | 5.2 | 9.9 | 9.6 | 0.0 | 19.5 | 36.7 | 9.8 | 0.4 | 46.9 | 205.2 | 14.3 | 0.1 | 219.6 |
| 75 | 1.058 | 1.4 | 4.4 | 0.0 | 5.8 | 10.0 | 9.9 | 0.1 | 20.0 | 37.0 | 9.8 | 0.4 | 47.1 | 206.1 | 14.5 | 0.1 | 220.7 |
| 76 | 1.072 | 1.4 | 4.9 | 0.0 | 6.3 | 10.0 | 10.1 | 0.2 | 20.3 | 37.3 | 9.8 | 0.3 | 47.4 | 207.0 | 14.7 | 0.1 | 221.8 |
| 77 | 1.087 | 1.3 | 5.5 | 0.0 | 6.8 | 10.1 | 10.2 | 0.2 | 20.5 | 37.6 | 9.7 | 0.3 | 47.6 | 208.1 | 14.7 | 0.2 | 223.0 |
| 78 | 1.101 | 1.2 | 5.9 | 0.1 | 7.2 | 10.1 | 10.2 | 0.3 | 20.6 | 38.0 | 9.5 | 0.2 | 47.7 | 209.1 | 14.6 | 0.3 | 224.0 |
| 79 | 1.115 | 1.1 | 6.4 | 0.1 | 7.6 | 10.0 | 10.2 | 0.4 | 20.6 | 38.3 | 9.1 | 0.2 | 47.6 | 210.0 | 14.4 | 0.3 | 224.8 |
| 80 | 1.130 | 1.1 | 6.7 | 0.1 | 7.8 | 10.0 | 10.1 | 0.5 | 20.5 | 38.6 | 8.7 | 0.1 | 47.4 | 210.8 | 14.3 | 0.4 | 225.5 |
| 81 | 1.144 | 1.0 | 7.0 | 0.1 | 8.0 | 9.9 | 9.9 | 0.5 | 20.4 | 38.9 | 8.1 | 0.1 | 47.1 | 211.3 | 14.4 | 0.4 | 226.1 |
| 82 | 1.158 | 0.9 | 7.2 | 0.1 | 8.1 | 9.9 | 9.8 | 0.6 | 20.2 | 39.1 | 7.6 | 0.1 | 46.7 | 211.7 | 14.7 | 0.3 | 226.6 |
| 83 | 1.173 | 0.8 | 7.3 | 0.1 | 8.2 | 9.8 | 9.6 | 0.6 | 19.9 | 39.2 | 7.0 | 0.0 | 46.2 | 211.9 | 14.9 | 0.2 | 227.0 |
| 84 | 1.187 | 0.7 | 7.4 | 0.1 | 8.2 | 9.7 | 9.3 | 0.6 | 19.6 | 39.3 | 6.5 | 0.0 | 45.8 | 211.8 | 15.2 | 0.1 | 227.2 |
| 85 | 1.201 | 0.7 | 7.3 | 0.1 | 8.1 | 9.5 | 9.1 | 0.6 | 19.2 | 39.3 | 6.0 | 0.0 | 45.3 | 211.6 | 15.6 | 0.1 | 227.4 |
| 86 | 1.215 | 0.6 | 7.2 | 0.1 | 7.9 | 9.4 | 8.7 | 0.6 | 18.8 | 39.2 | 5.7 | 0.0 | 44.9 | 211.3 | 16.1 | 0.1 | 227.4 |
| 87 | 1.230 | 0.6 | 6.8 | 0.1 | 7.5 | 9.3 | 8.2 | 0.6 | 18.2 | 39.0 | 5.5 | 0.0 | 44.6 | 210.8 | 16.7 | 0.1 | 227.5 |
| 88 | 1.244 | 0.6 | 6.4 | 0.1 | 7.1 | 9.2 | 7.6 | 0.6 | 17.5 | 38.8 | 5.5 | 0.0 | 44.4 | 210.1 | 17.4 | 0.1 | 227.6 |
| 89 | 1.258 | 0.7 | 5.7 | 0.1 | 6.4 | 9.1 | 6.9 | 0.6 | 16.6 | 38.6 | 5.6 | 0.0 | 44.2 | 209.3 | 18.2 | 0.1 | 227.6 |
| 90 | 1.273 | 0.7 | 4.8 | 0.1 | 5.5 | 9.0 | 6.2 | 0.5 | 15.6 | 38.3 | 5.8 | 0.0 | 44.1 | 208.5 | 18.9 | 0.1 | 227.5 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 91 | 1.287 | 0.8 | 3.8 | 0.0 | 4.6 | 8.9 | 5.4 | 0.3 | 14.6 | 38.0 | 6.0 | 0.0 | 44.0 | 207.6 | 19.4 | 0.1 | 227.2 |
| 92 | 1.301 | 0.8 | 2.8 | 0.0 | 3.6 | 8.8 | 4.6 | 0.2 | 13.6 | 37.7 | 6.4 | 0.0 | 44.0 | 206.7 | 20.0 | 0.2 | 226.8 |
| 93 | 1.316 | 0.8 | 1.9 | 0.0 | 2.7 | 8.8 | 4.0 | 0.1 | 12.8 | 37.4 | 6.8 | 0.0 | 44.2 | 205.9 | 20.5 | 0.2 | 226.5 |
| 94 | 1.330 | 0.8 | 1.2 | 0.0 | 2.0 | 8.7 | 3.5 | 0.0 | 12.2 | 37.2 | 7.4 | 0.0 | 44.6 | 205.1 | 21.0 | 0.3 | 226.4 |
| 95 | 1.344 | 0.8 | 0.7 | 0.0 | 1.5 | 8.6 | 3.0 | 0.0 | 11.7 | 37.1 | 7.9 | 0.0 | 45.0 | 204.6 | 21.5 | 0.3 | 226.4 |
| 96 | 1.358 | 0.8 | 0.5 | 0.0 | 1.3 | 8.6 | 2.7 | 0.0 | 11.3 | 37.0 | 8.4 | 0.0 | 45.4 | 204.2 | 22.3 | 0.3 | 226.8 |
| 97 | 1.373 | 0.7 | 0.3 | 0.0 | 1.1 | 8.6 | 2.4 | 0.1 | 11.0 | 37.0 | 8.6 | 0.0 | 45.6 | 204.0 | 23.1 | 0.3 | 227.4 |
| 98 | 1.387 | 0.7 | 0.2 | 0.0 | 1.0 | 8.5 | 2.2 | 0.1 | 10.8 | 37.0 | 8.6 | 0.0 | 45.6 | 204.0 | 24.0 | 0.2 | 228.2 |
| 99 | 1.401 | 0.6 | 0.2 | 0.0 | 0.8 | 8.5 | 2.0 | 0.1 | 10.6 | 37.1 | 8.3 | 0.0 | 45.4 | 204.2 | 24.6 | 0.1 | 228.9 |
| 100 | 1.416 | 0.6 | 0.1 | 0.0 | 0.7 | 8.5 | 1.7 | 0.1 | 10.4 | 37.2 | 7.8 | 0.0 | 45.1 | 204.7 | 24.8 | 0.0 | 229.5 |
| 101 | 1.430 | 0.5 | 0.1 | 0.0 | 0.6 | 8.6 | 1.5 | 0.1 | 10.2 | 37.4 | 7.2 | 0.0 | 44.6 | 205.3 | 24.7 | 0.0 | 230.0 |
| 102 | 1.444 | 0.5 | 0.0 | 0.0 | 0.6 | 8.6 | 1.2 | 0.1 | 9.9 | 37.6 | 6.4 | 0.0 | 44.0 | 206.1 | 24.2 | 0.0 | 230.3 |
| 103 | 1.459 | 0.5 | 0.0 | 0.0 | 0.5 | 8.6 | 0.9 | 0.1 | 9.6 | 37.8 | 5.5 | 0.0 | 43.3 | 206.9 | 23.3 | 0.1 | 230.2 |
| 104 | 1.473 | 0.5 | 0.0 | 0.0 | 0.5 | 8.6 | 0.6 | 0.1 | 9.3 | 37.9 | 4.6 | 0.0 | 42.5 | 207.6 | 21.8 | 0.1 | 229.5 |
| 105 | 1.487 | 0.5 | 0.0 | 0.0 | 0.5 | 8.6 | 0.4 | 0.1 | 9.1 | 38.1 | 3.7 | 0.0 | 41.8 | 208.3 | 19.7 | 0.1 | 228.1 |
| 106 | 1.501 | 0.5 | 0.0 | 0.0 | 0.5 | 8.6 | 0.2 | 0.1 | 8.9 | 38.2 | 2.9 | 0.1 | 41.1 | 208.9 | 16.9 | 0.1 | 225.9 |

**TABLE A.7 Power Generation/Absorption and Transfer—Ankle, Knee, and Hip**

| | | Muscle Power Gen(+)/ABS(−) | | | Rate of Transfer Across Joints and Muscle | | | | | | Segment Angular Velocity | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Leg to Foot | | Thigh to Leg | | Pelvis to Thigh | | | | | |
| Frame | Time S | Ankle W | Knee W | Hip W | Joint W | Muscle W | Joint W | Muscle W | Joint W | Muscle W | Foot R/S | Leg R/S | Thigh R/S | Hat R/S |
| 2 | 0.014 | −2.8 | −37.3 | 51.4 | 49.4 | −2.7 | 110.5 | 0.0 | 56.1 | 12.6 | −3.46 | −1.70 | 3.59 | 0.71 |
| 3 | 0.029 | −0.4 | −32.0 | 45.6 | 46.0 | −1.2 | 85.6 | 0.0 | 29.6 | 7.2 | −1.06 | −0.80 | 3.81 | 0.52 |
| 4 | 0.043 | 1.3 | −24.4 | 38.7 | 41.3 | 0.3 | 62.9 | 1.4 | 17.6 | 4.0 | 1.18 | 0.21 | 3.95 | 0.37 |
| 5 | 0.057 | 2.1 | −15.9 | 31.6 | 36.8 | 1.4 | 44.7 | 7.2 | 14.8 | 2.4 | 3.14 | 1.24 | 3.98 | 0.28 |
| 6 | 0.072 | 2.3 | −8.0 | 24.3 | 32.8 | 2.0 | 31.6 | 10.6 | 15.2 | 1.8 | 4.74 | 2.21 | 3.89 | 0.27 |
| 7 | 0.086 | 2.0 | −2.1 | 16.8 | 28.9 | 2.2 | 22.6 | 11.0 | 14.6 | 1.6 | 5.91 | 3.08 | 3.68 | 0.33 |
| 8 | 0.100 | 1.6 | 1.0 | 10.0 | 24.6 | 2.1 | 17.4 | 7.6 | 12.2 | 1.4 | 6.66 | 3.81 | 3.36 | 0.41 |
| 9 | 0.114 | 1.2 | 1.4 | 5.1 | 20.1 | 2.1 | 14.9 | 3.0 | 8.2 | 1.0 | 7.03 | 4.41 | 2.99 | 0.50 |
| 10 | 0.129 | 1.0 | −0.2 | 1.9 | 15.2 | 2.1 | 13.7 | −0.2 | 2.6 | 0.6 | 7.16 | 4.90 | 2.58 | 0.59 |
| 11 | 0.143 | 0.8 | −3.3 | 0.0 | 10.0 | 2.3 | 12.5 | −2.3 | −3.8 | 0.0 | 7.17 | 5.28 | 2.16 | 0.68 |
| 12 | 0.157 | 0.7 | −7.3 | −0.8 | 4.1 | 2.7 | 10.3 | −3.3 | −10.6 | −0.6 | 7.13 | 5.56 | 1.74 | 0.76 |
| 13 | 0.172 | 0.7 | −12.1 | −0.8 | −2.3 | 3.1 | 6.1 | −3.6 | −18.4 | −1.3 | 7.08 | 5.75 | 1.33 | 0.83 |
| 14 | 0.186 | 0.7 | −17.3 | −0.2 | −9.1 | 3.4 | −0.8 | −3.3 | −27.4 | −2.1 | 7.06 | 5.86 | 0.94 | 0.85 |
| 15 | 0.200 | 0.7 | −22.4 | 0.9 | −15.6 | 3.7 | −10.0 | −2.4 | −36.6 | −2.1 | 7.06 | 5.91 | 0.58 | 0.82 |
| 16 | 0.215 | 0.7 | −27.9 | 2.6 | −22.0 | 3.8 | −20.9 | −1.1 | −45.3 | −1.2 | 7.06 | 5.91 | 0.23 | 0.76 |
| 17 | 0.229 | 0.7 | −34.4 | 5.2 | −28.7 | 3.7 | −32.6 | 0.0 | −54.1 | 0.0 | 7.02 | 5.85 | −0.11 | 0.67 |
| 18 | 0.243 | 0.7 | −42.0 | 8.5 | −36.2 | 3.3 | −43.6 | 0.0 | −62.3 | 0.0 | 6.90 | 5.73 | −0.43 | 0.56 |
| 19 | 0.257 | 0.5 | −49.9 | 12.2 | −44.1 | 2.6 | −52.6 | 0.0 | −68.6 | 0.0 | 6.66 | 5.51 | −0.70 | 0.46 |
| 20 | 0.272 | 0.3 | −57.2 | 15.7 | −51.3 | 1.6 | −59.6 | 0.0 | −73.1 | 0.0 | 6.25 | 5.16 | −0.91 | 0.37 |
| 21 | 0.286 | 0.1 | −62.3 | 18.7 | −56.6 | 0.4 | −65.4 | 0.0 | −76.3 | 0.0 | 5.61 | 4.61 | −1.02 | 0.32 |
| 22 | 0.300 | −0.1 | −62.4 | 21.3 | −58.4 | −0.5 | −69.8 | 0.0 | −76.3 | 0.0 | 4.71 | 3.85 | −1.03 | 0.31 |
| 23 | 0.315 | −0.2 | −54.6 | 23.0 | −55.6 | −1.0 | −72.5 | 0.0 | −72.4 | 0.0 | 3.53 | 2.88 | −0.94 | 0.34 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24 | 0.329 | −0.2 | −38.4 | 23.2 | −47.9 | −0.9 | −73.4 | 0.0 | −66.8 | 0.0 | 2.11 | 1.75 | −0.79 | 0.42 |
| | 25 | 0.343 | 0.0 | −17.7 | 21.1 | −36.8 | −0.3 | −71.5 | 0.0 | −61.7 | 0.0 | 0.49 | 0.58 | −0.63 | 0.50 |
| | 26 | 0.357 | 0.4 | 0.2 | 16.6 | −25.2 | 0.2 | −65.9 | 6.3 | −58.0 | 0.0 | −1.27 | −0.51 | −0.49 | 0.53 |
| | 27 | 0.372 | 0.4 | 9.3 | 10.8 | −16.1 | 0.4 | −56.4 | 3.9 | −55.4 | 0.0 | −2.99 | −1.39 | −0.41 | 0.50 |
| HCR | 28 | 0.386 | 4.0 | 53.9 | 44.0 | −12.7 | 3.3 | −99.0 | 13.3 | −113.1 | 0.0 | −4.40 | −1.99 | −0.39 | 0.41 |
| | 29 | 0.400 | −13.3 | 38.2 | 25.9 | 50.6 | −10.7 | −28.3 | 8.1 | −47.0 | 0.0 | −5.24 | −2.33 | −0.41 | 0.28 |
| | 30 | 0.415 | −23.5 | 16.0 | 12.3 | 86.6 | −20.7 | 22.6 | 3.1 | 0.8 | 0.0 | −5.34 | −2.50 | −0.41 | 0.12 |
| | 31 | 0.429 | −6.2 | 10.2 | 6.2 | 91.8 | −7.4 | 43.2 | 1.6 | 15.1 | 1.3 | −4.80 | −2.61 | −0.36 | −0.06 |
| | 32 | 0.443 | −8.3 | −18.6 | 0.4 | 76.0 | −18.5 | 39.0 | −2.2 | −2.7 | 2.7 | −3.88 | −2.68 | −0.29 | −0.25 |
| | 33 | 0.458 | −0.7 | −35.3 | −1.3 | 55.5 | −12.4 | 30.3 | −3.8 | −29.2 | 2.0 | −2.85 | −2.69 | −0.26 | −0.42 |
| | 34 | 0.472 | 3.5 | −55.3 | −0.1 | 39.6 | −9.3 | 31.1 | −9.1 | −43.5 | 0.1 | −1.88 | −2.60 | −0.37 | −0.55 |
| | 35 | 0.486 | 3.3 | −55.8 | −0.2 | 29.2 | −2.9 | 40.9 | −20.3 | −41.8 | −2.8 | −1.12 | −2.41 | −0.64 | −0.59 |
| | 36 | 0.500 | −0.8 | −38.8 | −3.5 | 20.5 | 0.3 | 51.5 | −36.2 | −36.0 | −4.1 | −0.60 | −2.15 | −1.04 | −0.56 |
| | 37 | 0.515 | 0.3 | −16.0 | −9.5 | 11.5 | −0.1 | 55.7 | −54.9 | −38.9 | −4.9 | −0.29 | −1.88 | −1.45 | −0.49 |
| | 38 | 0.529 | −5.4 | 5.3 | −6.9 | 3.2 | 0.4 | 52.9 | −53.3 | −48.4 | −2.1 | −0.12 | −1.64 | −1.81 | −0.43 |
| | 39 | 0.543 | −7.3 | 16.6 | −5.0 | −2.5 | 0.1 | 46.3 | −41.1 | −51.6 | −1.3 | −0.02 | −1.46 | −2.05 | −0.41 |
| | 40 | 0.558 | −9.0 | 21.0 | −8.0 | −6.7 | 0.0 | 37.1 | −33.0 | −42.9 | −2.2 | 0.03 | −1.33 | −2.18 | −0.47 |
| | 41 | 0.572 | −13.6 | 19.3 | −10.4 | −11.9 | 0.0 | 25.0 | −25.0 | −27.6 | −3.7 | 0.06 | −1.24 | −2.19 | −0.58 |
| | 42 | 0.586 | −12.8 | 18.4 | −16.7 | −18.5 | 0.0 | 12.9 | −23.4 | −12.7 | −8.6 | 0.03 | −1.18 | −2.11 | −0.72 |
| | 43 | 0.601 | −15.2 | 13.1 | −14.2 | −24.7 | 1.2 | 6.0 | −18.3 | −0.1 | −10.8 | −0.09 | −1.16 | −1.99 | −0.86 |
| | 44 | 0.615 | −16.8 | 7.7 | −9.7 | −28.2 | 5.0 | 8.3 | −12.8 | 12.1 | −10.7 | −0.27 | −1.17 | −1.87 | −0.98 |
| | 45 | 0.629 | −16.6 | 4.7 | −7.1 | −28.3 | 9.7 | 18.3 | −9.1 | 26.1 | −10.8 | −0.43 | −1.17 | −1.77 | −1.07 |
| | 46 | 0.643 | −16.5 | 3.5 | −6.3 | −24.7 | 12.9 | 31.5 | −7.7 | 41.5 | −12.7 | −0.51 | −1.16 | −1.70 | −1.14 |
| | 47 | 0.658 | −18.4 | 3.3 | −6.4 | −18.7 | 13.7 | 43.7 | −7.6 | 56.4 | −16.4 | −0.49 | −1.15 | −1.65 | −1.19 |
| | 48 | 0.672 | −22.5 | 3.4 | −7.1 | −13.0 | 12.3 | 52.2 | −8.0 | 69.0 | −20.2 | −0.41 | −1.14 | −1.63 | −1.21 |
| | 49 | 0.686 | −28.1 | 2.9 | −8.3 | −10.0 | 10.7 | 54.6 | −6.9 | 76.9 | −20.9 | −0.32 | −1.16 | −1.65 | −1.18 |
| | 50 | 0.701 | −32.6 | 1.2 | −8.7 | −10.9 | 13.1 | 50.2 | −2.7 | 78.3 | −16.9 | −0.34 | −1.18 | −1.69 | −1.12 |

*(continued)*

**TABLE A.7** *(Continued)*

| | | | Muscle Power Gen(+)/ABS(−) | | | Rate of Transfer Across Joints and Muscle | | | | | | Segment Angular Velocity | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Leg to Foot | | Thigh to Leg | | Pelvis to Thigh | | | | | |
| | Frame | Time S | Ankle W | Knee W | Hip W | Joint W | Muscle W | Joint W | Muscle W | Joint W | Muscle W | Foot R/S | Leg R/S | Thigh R/S | Hat R/S |
| | 51 | 0.715 | −31.2 | −1.2 | −7.8 | −15.4 | 23.1 | 40.2 | 2.7 | 74.2 | −11.7 | −0.51 | −1.20 | −1.75 | −1.05 |
| | 52 | 0.729 | −20.0 | 0.0 | −11.5 | −23.7 | 36.0 | 27.5 | 0.1 | 69.5 | −14.6 | −0.79 | −1.23 | −1.79 | −1.00 |
| | 53 | 0.744 | −10.8 | −2.5 | −10.0 | −36.4 | 58.2 | 14.7 | 6.4 | 68.6 | −12.0 | −1.09 | −1.29 | −1.79 | −0.98 |
| | 54 | 0.758 | −3.8 | −2.3 | −11.7 | −54.6 | 77.7 | 3.0 | 8.6 | 70.4 | −14.2 | −1.32 | −1.39 | −1.76 | −0.97 |
| | 55 | 0.772 | −1.8 | −1.0 | −12.1 | −80.0 | 97.4 | −8.1 | 12.1 | 68.7 | −15.6 | −1.50 | −1.53 | −1.66 | −0.94 |
| | 56 | 0.786 | −0.8 | 2.2 | −10.4 | −113.2 | 121.4 | −19.1 | 15.7 | 59.9 | −14.6 | −1.71 | −1.72 | −1.51 | −0.88 |
| | 57 | 0.801 | 6.1 | 7.6 | −8.5 | −150.5 | 149.1 | −27.8 | 16.4 | 48.6 | −12.8 | −2.01 | −1.93 | −1.32 | −0.79 |
| | 58 | 0.815 | 26.5 | 12.8 | −8.3 | −187.0 | 177.3 | −31.0 | 13.8 | 42.8 | −12.1 | −2.46 | −2.14 | −1.11 | −0.66 |
| | 59 | 0.829 | 65.3 | 14.5 | −9.8 | −222.4 | 204.4 | −28.5 | 9.0 | 44.0 | −11.4 | −3.10 | −2.35 | −0.90 | −0.48 |
| | 60 | 0.844 | 120.8 | 12.0 | −11.8 | −260.9 | 228.2 | −22.8 | 4.3 | 49.0 | −8.0 | −3.89 | −2.55 | −0.67 | −0.27 |
| | 61 | 0.858 | 181.5 | 5.1 | −13.0 | −303.1 | 246.0 | −15.9 | 0.9 | 54.8 | −1.6 | −4.76 | −2.74 | −0.43 | −0.05 |
| | 62 | 0.872 | 232.2 | −6.3 | −12.0 | −344.4 | 254.6 | −10.7 | −0.3 | 57.2 | 0.0 | −5.62 | −2.94 | −0.14 | 0.18 |
| | 63 | 0.887 | 263.5 | −21.7 | −8.1 | −376.4 | 249.1 | −12.8 | 0.0 | 49.2 | 7.1 | −6.43 | −3.13 | 0.19 | 0.41 |
| | 64 | 0.901 | 272.4 | −38.9 | −2.6 | −387.8 | 225.0 | −24.0 | 0.0 | 27.1 | 18.9 | −7.25 | −3.28 | 0.56 | 0.64 |
| | 65 | 0.915 | 254.1 | −54.0 | 2.8 | −366.0 | 182.6 | −36.6 | 0.0 | −3.4 | 23.8 | −8.03 | −3.36 | 0.97 | 0.86 |
| | 66 | 0.929 | 203.4 | −62.7 | 6.9 | −307.3 | 129.2 | −39.1 | 0.0 | −28.9 | 22.2 | −8.58 | −3.33 | 1.40 | 1.07 |
| | 67 | 0.944 | 130.7 | −62.9 | 9.8 | −221.6 | 77.0 | −24.4 | 0.0 | −37.9 | 18.5 | −8.57 | −3.18 | 1.86 | 1.22 |
| | 68 | 0.958 | 60.7 | −54.9 | 12.4 | −125.8 | 35.5 | 5.8 | 0.0 | −29.0 | 15.0 | −7.81 | −2.88 | 2.31 | 1.27 |
| | 69 | 0.972 | 14.0 | −35.3 | 14.2 | −31.8 | 8.9 | 44.1 | 0.0 | −8.1 | 11.0 | −6.31 | −2.46 | 2.73 | 1.19 |
| TOR | 70 | 0.987 | −3.3 | −18.2 | 18.7 | 40.6 | −2.6 | 81.8 | 0.0 | 18.1 | 9.2 | −4.28 | −1.91 | 3.10 | 1.02 |