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****************************************************************************
***
   DYNAMIC MOCAP MODEL
   joint file

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   This file contains the segments joints, gencoords, and constraint
functions
   for the dynamic SIMM model of an average adult male. It is based on the
full-body
   model that was compiled from several sources, including:

   Scott Delp, Ph.D., Stanford University
   Wendy Murray, Ph.D., Stanford University
   Silvia Salinas Blemker, M.S., Stanford University
   Anita Vasavada, Ph.D., Washington State University
   Srikanth Suryanarayanan, M.S., Rehabilitation Institute of Chicago
   Frans van der Helm, Ph.D., Delft University

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***/

name Dynamic Mocap Model

bone_path bones
muscle_file dynamic_light.msl
marker_visibility off
marker_radius 0.005000
force_units N
length_units m
MV_gear 0.080000
solver_accuracy 0.000100

#ifndef GROUND_PLANE_DEFINED
   #define GROUND_PLANE_XY 1
#endif


#if GROUND_PLANE_XY
   #define SHADOW_PARAMS shadow Z 0.001
   gravity -Z
#elif GROUND_PLANE_XZ
   #define SHADOW_PARAMS shadow Y 0.001
   gravity -Y
#else
   #define SHADOW_PARAMS shadow X 0.001
   gravity -X
#endif

/* The inverse dynamics algorithm that applies corrective
 * torques to make the model follow the input motion
 * (selected using the "joint torques (w/corrections)"
 * option in the Dynamics Tool) uses the pd_stiffness
 * value in each gencoord definition to determine the
 * corrective torques. The following constants are
 * shortcuts for defining those values.
 */
#define PD_ANKLE 0.001
#define PD_KNEE 0.0001
#define PD_OTHER 0.0001

/* To enhance the knee model to include varus/valgus motion,
 * set VARUS_VALGUS to 1.
 */
#define VARUS_VALGUS 0
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/* These are the weights of the various markers in the
 * mocap model. Solver uses them to determine which markers
 * it should try harder to fit to the marker cloud data.
 * 1.0 is the default, and numbers greater than 1.0 tell
 * Solver to try harder for those markers.
 */
#define FOOT_WEIGHT 2.0
#define PELVIS_WEIGHT 2.0
#define WRIST_WEIGHT 2.0
#define ARM_WEIGHT 2.0
#define OTHER_WEIGHT 1.0


/* The following distribution of mass parameters was taken from:
 * de Leva, P., "Adjustments to Zatsiorsky-Seluyanov's Segment
 *     Inertia Parameters," Journal of Biomechanics, Vol. 29, No. 9,
 *     pp. 1223-1230, 1996.
 * Lafond, D., Prince, F., "Extended Adjustements of Zatsiorsky-
 *     Seluyanov's Mass Inertia Parameters," submitted for publication,
 *     2003.
 * The following changes were made:
 * (1) the torso segment in the SIMM model is equivalent to the
 *     upper trunk and the middle trunk in the Zatsirosky-Seluyanov
 *     model. The parallel axis theorem was used to determine the
 *     inertial parameters for these two sections combined.
 * (2) the foot in the Zatsirosky-Seluyanov was divided into the
 *     foot segment and the toes segment in the SIMM model, using
 *     the parallel axis theorm, and the assumption that the toes
 *     weigh 100 grams in the average male.
 * (3) the mass of the patella in the average male was estimated to be
 *     100 grams, and was taken out of the mass of the thigh. The
 *     inertial properties of the thigh were not modified.
 * (4) the mass and inertial properties of the lower arm were split
 *     equally between the radius and ulna.
 * (5) the mass of the talus in the average male was estimated to be
 *     50 grams, and was taken out of the mass of the foot. The inertial
 *     properties of the foot were not modified.
 */
#define BODY_MASS 75.0
#define TORSO_MASS {0.3229 * BODY_MASS}
#define PELVIS_MASS {0.1117 * BODY_MASS}
#define HEAD_MASS {0.0694 * BODY_MASS}
#define UPPER_ARM_MASS {0.0271 * BODY_MASS}
#define LOWER_ARM_MASS {0.0162 * BODY_MASS}
#define ULNA_MASS {0.5 * LOWER_ARM_MASS}
#define RADIUS_MASS {0.5 * LOWER_ARM_MASS}
#define HAND_MASS {0.0061 * BODY_MASS}
#define THIGH_MASS {0.1403 * BODY_MASS}
#define PATELLA_MASS {0.0013 * BODY_MASS}
#define SHANK_MASS {0.0433 * BODY_MASS}
#define FOOT_MASS {0.0118 * BODY_MASS}
#define TALUS_MASS {0.0006 * BODY_MASS}
#define TOES_MASS {0.0013 * BODY_MASS}
#define HAT_MASS {0.4911 * BODY_MASS}

#define PELVIS_DEPTH 0.184400    /* mocap scaling: sacral marker to mid point
of ASIS markers */
#define PELVIS_HEIGHT 0.076200   /* mocap scaling: Y distance from hip center
to mid point of ASIS markers */
#define PELVIS_WIDTH 0.256000    /* mocap scaling: distance between ASIS
markers */
#define HIP_Y_PELVIS -0.0824     /* Y coordinate of hip center in pelvis
frame */
#define NAVEL_Y_PELVIS 0.0633    /* Y coordinate of navel in pelvis frame */
#define PELVIS_CM_X -0.0893      /* estimated */
#define PELVIS_CM_Y {NAVEL_Y_PELVIS - 0.6115 * (NAVEL_Y_PELVIS -
HIP_Y_PELVIS)}
#define PELVIS_CM_Z 0.0
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#define PELVIS_GYR_X {0.551 * (NAVEL_Y_PELVIS - HIP_Y_PELVIS)}
#define PELVIS_GYR_Y {0.587 * (NAVEL_Y_PELVIS - HIP_Y_PELVIS)}
#define PELVIS_GYR_Z {0.615 * (NAVEL_Y_PELVIS - HIP_Y_PELVIS)}
#define PELVIS_INERTIA_X {PELVIS_MASS * PELVIS_GYR_X * PELVIS_GYR_X}
#define PELVIS_INERTIA_Y {PELVIS_MASS * PELVIS_GYR_Y * PELVIS_GYR_Y}
#define PELVIS_INERTIA_Z {PELVIS_MASS * PELVIS_GYR_Z * PELVIS_GYR_Z}

#define THIGH_LENGTH 0.3960 /* hip joint center to knee joint "center" */
#define THIGH_CM_X 0.0
#define THIGH_CM_Y {-0.4095 * THIGH_LENGTH}
#define THIGH_CM_Z 0.0
#define THIGH_GYR_X {0.329 * THIGH_LENGTH}
#define THIGH_GYR_Y {0.149 * THIGH_LENGTH}
#define THIGH_GYR_Z {0.329 * THIGH_LENGTH}
#define THIGH_INERTIA_X {THIGH_MASS * THIGH_GYR_X * THIGH_GYR_X}
#define THIGH_INERTIA_Y {THIGH_MASS * THIGH_GYR_Y * THIGH_GYR_Y}
#define THIGH_INERTIA_Z {THIGH_MASS * THIGH_GYR_Z * THIGH_GYR_Z}

#define PATELLA_CM_X 0.0018  /* estimated */
#define PATELLA_CM_Y 0.0264  /* estimated */
#define PATELLA_CM_Z 0.0     /* estimated */
#define PAT_HEIGHT 0.025     /* estimated */
#define PAT_RADIUS 0.020     /* estimated */
#define PATELLA_INERTIA_X {PATELLA_MASS * PAT_RADIUS * PAT_RADIUS * 0.0833}
#define PATELLA_INERTIA_Y {PATELLA_MASS * ((PAT_RADIUS * PAT_RADIUS * 0.25)
+ (PAT_HEIGHT * PAT_HEIGHT * 0.08333))}
#define PATELLA_INERTIA_Z {PATELLA_MASS * ((PAT_RADIUS * PAT_RADIUS * 0.25)
+ (PAT_HEIGHT * PAT_HEIGHT * 0.08333))}

#define SHANK_LENGTH 0.3907  /* knee joint "center" to ankle joint center */
#define SHANK_CM_X 0.0
#define SHANK_CM_Y {-0.4395 * SHANK_LENGTH}
#define SHANK_CM_Z 0.0
#define SHANK_GYR_X {0.246 * SHANK_LENGTH}
#define SHANK_GYR_Y {0.102 * SHANK_LENGTH}
#define SHANK_GYR_Z {0.251 * SHANK_LENGTH}
#define SHANK_INERTIA_X {SHANK_MASS * SHANK_GYR_X * SHANK_GYR_X}
#define SHANK_INERTIA_Y {SHANK_MASS * SHANK_GYR_Y * SHANK_GYR_Y}
#define SHANK_INERTIA_Z {SHANK_MASS * SHANK_GYR_Z * SHANK_GYR_Z}

#define TALUS_CM_X 0.0055  /* estimated */
#define TALUS_CM_Y 0.0023  /* estimated */
#define TALUS_CM_Z 0.0
#define TAL_HEIGHT 0.016
#define TAL_RADIUS 0.015
#define TALUS_INERTIA_X {TALUS_MASS * ((TAL_RADIUS * TAL_RADIUS * 0.25) +
(TAL_HEIGHT * TAL_HEIGHT * 0.08333))}
#define TALUS_INERTIA_Y {TALUS_MASS * TAL_RADIUS * TAL_RADIUS * 0.0833}
#define TALUS_INERTIA_Z {TALUS_MASS * ((TAL_RADIUS * TAL_RADIUS * 0.25) +
(TAL_HEIGHT * TAL_HEIGHT * 0.08333))}

#define FOOT_LENGTH  0.2670          /* mocap scaling: heel marker to toe
marker */
#define HEEL_X_FOOT -0.0080          /* X coordinate of back of heel in foot
frame */
#define TOES_START_X_FOOT 0.18865  /* X coordinate of start of toes segment
*/
#define FOOT_CM_X {0.518 * (TOES_START_X_FOOT - HEEL_X_FOOT)}
#define FOOT_CM_Y 0.0156     /* estimated */
#define FOOT_CM_Z 0.0
#define FOOT_GYR_X {0.163 * (TOES_START_X_FOOT - (HEEL_X_FOOT))}
#define FOOT_GYR_Y {0.260 * (TOES_START_X_FOOT - (HEEL_X_FOOT))}
#define FOOT_GYR_Z {0.280 * (TOES_START_X_FOOT - (HEEL_X_FOOT))}
#define FOOT_INERTIA_X {FOOT_MASS * FOOT_GYR_X * FOOT_GYR_X}
#define FOOT_INERTIA_Y {FOOT_MASS * FOOT_GYR_Y * FOOT_GYR_Y}
#define FOOT_INERTIA_Z {FOOT_MASS * FOOT_GYR_Z * FOOT_GYR_Z}

#define TOES_LENGTH 0.0614   /* estimated */
#define TOES_CM_X {0.5000 * TOES_LENGTH}
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#define TOES_CM_Y -0.0026      /* estimated */
#define TOES_CM_Z 0.0105       /* estimated */
#define TOES_GYR_X {0.521 * TOES_LENGTH}
#define TOES_GYR_Y {0.833 * TOES_LENGTH}
#define TOES_GYR_Z {0.894 * TOES_LENGTH}
#define TOES_INERTIA_X {TOES_MASS * TOES_GYR_X * TOES_GYR_X}
#define TOES_INERTIA_Y {TOES_MASS * TOES_GYR_Y * TOES_GYR_Y}
#define TOES_INERTIA_Z {TOES_MASS * TOES_GYR_Z * TOES_GYR_Z}


/*******************************************/
/*                SEGMENTS                 */
/*******************************************/

beginsegment ground
endsegment

beginsegment pelvis
bone pelvis_rv.asc
bone pelvis_lv.asc
bone sacrumv.asc
material my_bone
SHADOW_PARAMS
begingroups spine torso right leg_r hip_r left leg_l hip_l endgroups
marker V.Sacral     -0.17 0.0 0.0 PELVIS_WEIGHT
marker Sacral -0.17 0.0 0.0 PELVIS_WEIGHT
marker V.Sacrum      -0.17 0.0 0.0 PELVIS_WEIGHT
marker Sacrum -0.17 0.0 0.0 PELVIS_WEIGHT
marker SACR   -0.17 0.0 0.0 PELVIS_WEIGHT
marker VSAC   -0.17 0.0 0.0 PELVIS_WEIGHT
marker BPV    -0.155 0.0 0.0 PELVIS_WEIGHT
marker R.ASIS 0.0 0.0 0.128 PELVIS_WEIGHT
marker RASIS 0.0 0.0 0.128 PELVIS_WEIGHT
marker RASI   0.0 0.0 0.128 PELVIS_WEIGHT
marker RILI   0.0 0.0 0.128 PELVIS_WEIGHT
marker R.PSIS -0.148 0.000 0.047 PELVIS_WEIGHT
marker RPSIS  -0.148 0.000 0.047 PELVIS_WEIGHT
marker RPSI   -0.148 0.000 0.047 PELVIS_WEIGHT
marker TRPV   -0.148 0.000 0.047 PELVIS_WEIGHT
marker R.Trochanter -0.005 -0.042 0.093 PELVIS_WEIGHT
marker RTRC   -0.005 -0.042 0.093 PELVIS_WEIGHT
marker L.ASIS 0.0 0.0 -0.128 PELVIS_WEIGHT
marker LASIS 0.0 0.0 -0.128 PELVIS_WEIGHT
marker LASI   0.0 0.0 -0.128 PELVIS_WEIGHT
marker LILI   0.0 0.0 -0.128 PELVIS_WEIGHT
marker L.PSIS -0.148 0.000 -0.047 PELVIS_WEIGHT
marker LPSIS  -0.148 0.000 -0.047 PELVIS_WEIGHT
marker LPSI   -0.148 0.000 -0.047 PELVIS_WEIGHT
marker TLPV   -0.148 0.000 -0.047 PELVIS_WEIGHT
marker L.Trochanter -0.005 -0.042 -0.093 PELVIS_WEIGHT
marker LTRC   -0.005 -0.042 -0.093 PELVIS_WEIGHT
gait_scale PELVIS PELVIS_DEPTH PELVIS_HEIGHT PELVIS_WIDTH
mass PELVIS_MASS
masscenter PELVIS_CM_X PELVIS_CM_Y PELVIS_CM_Z
inertia PELVIS_INERTIA_X 0.0 0.0
        0.0 PELVIS_INERTIA_Y 0.0
        0.0 0.0 PELVIS_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 0.0 -1.0 0.0
htr_y -1.0 0.0 0.0
endsegment

beginsegment femur_r
bone femur_r.asc
material my_bone
SHADOW_PARAMS
begingroups right leg_r hip_r knee_r endgroups
marker R.Knee 0.0 -0.404 0.05 OTHER_WEIGHT
marker R.Knee.Lateral      0.0 -0.404 0.05 OTHER_WEIGHT
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marker R.Knee.Lat    0.0 -0.404 0.05 OTHER_WEIGHT
marker RKNE  0.0 -0.404 0.05 OTHER_WEIGHT
marker RKNL  0.0 -0.404 0.05 OTHER_WEIGHT
marker R.Knee.Medial       0.0 -0.404 -0.05 OTHER_WEIGHT
marker R.Knee.Med  0.0 -0.404 -0.05 OTHER_WEIGHT
marker R.Thigh        0.0179 -0.2240 0.1147 OTHER_WEIGHT
marker R.Thigh.Upper       0.0179 -0.2640 0.0647 OTHER_WEIGHT
marker R.Thigh.Front       0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Thigh.Rear -0.0479 -0.3240 0.0047 OTHER_WEIGHT
marker RTBL  0.0179 -0.2240 0.1147 OTHER_WEIGHT
marker RTBM  0.0179 -0.2640 0.0647 OTHER_WEIGHT
marker RTTL  0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker RTTM  -0.0479 -0.3240 0.0047 OTHER_WEIGHT
marker RTHI  0.0179 -0.2640 0.0647 OTHER_WEIGHT
marker R.Thigh.M1  0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Thigh.M2  0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Thigh.M3  0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Femur.Medial      0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Femur.Lateral     0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Femur.Anterior    0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Femur.Posterior   0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Femur.Proximal    0.0800 -0.3240 0.0047 OTHER_WEIGHT
marker R.Femur.Distal      0.0800 -0.3240 0.0047 OTHER_WEIGHT
gait_scale R_THIGH THIGH_LENGTH THIGH_LENGTH THIGH_LENGTH
mass THIGH_MASS
masscenter THIGH_CM_X THIGH_CM_Y THIGH_CM_Z
inertia THIGH_INERTIA_X 0.0 0.0
        0.0 THIGH_INERTIA_Y 0.0
        0.0 0.0 THIGH_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -1.0 0.0
endsegment

beginsegment tibia_r
bone tibia_r.asc
bone fibula_r.asc
material my_bone
SHADOW_PARAMS
begingroups right leg_r knee_r ankle_r endgroups
marker R.Ankle       -0.005 -0.41 0.053 FOOT_WEIGHT
marker R.Ankle.Lateral     -0.005 -0.41 0.053 FOOT_WEIGHT
marker R.Ankle.Lat  -0.005 -0.41 0.053 FOOT_WEIGHT
marker RANK  -0.005 -0.41 0.053 FOOT_WEIGHT
marker RMAL  -0.005 -0.41 0.053 FOOT_WEIGHT
marker R.Ankle.Medial      0.006 -0.3888 -0.038 FOOT_WEIGHT
marker R.Ankle.Med  0.006 -0.3888 -0.038 FOOT_WEIGHT
marker R.Shank        0.0104 -0.2322 0.0748 OTHER_WEIGHT
marker R.Shank.Upper       0.0125 -0.3196 0.0600 OTHER_WEIGHT
marker R.Shank.Front       0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker R.Shank.Rear -0.0325 -0.3596 0.0000 OTHER_WEIGHT
marker RSBL  0.0104 -0.2322 0.0748 OTHER_WEIGHT
marker RSBM  0.0125 -0.3196 0.0600 OTHER_WEIGHT
marker RSTL  0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker RSTM  -0.0325 -0.3596 0.0000 OTHER_WEIGHT
marker RTIB  0.0125 -0.3196 0.0600 OTHER_WEIGHT
marker R.Shank.M1   -0.008 -0.08 0.055 OTHER_WEIGHT fixed /* fibular head */
marker R.Shank.M2   0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker R.Shank.M3   0.0425 -0.3596 0.0000 OTHER_WEIGHT fixed /* medial tibia
*/
marker R.Shank.M4   0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker R.Shank.M5   0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker R.Fibula.Head       0.0256 -0.04157 0.05976 OTHER_WEIGHT fixed
marker R.Tibia.medial      0.02398 -0.05473 -0.04540 OTHER_WEIGHT fixed
marker R.Tibia.tub  0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker R.Tibia.prox 0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker R.Tibia.distal      0.0425 -0.3596 0.0000 OTHER_WEIGHT
gait_scale R_SHANK SHANK_LENGTH SHANK_LENGTH SHANK_LENGTH
mass SHANK_MASS
```

```
masscenter SHANK_CM_X SHANK_CM_Y SHANK_CM_Z
inertia SHANK_INERTIA_X 0.0 0.0
        0.0 SHANK_INERTIA_Y 0.0
        0.0 0.0 SHANK_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -1.0 0.0
endsegment

beginsegment patella_r
bone patella_r.asc
material my_bone
SHADOW_PARAMS
begingroups right leg_r knee_r endgroups
gait_scale R_SHANK SHANK_LENGTH SHANK_LENGTH SHANK_LENGTH
mass PATELLA_MASS
masscenter PATELLA_CM_X PATELLA_CM_Y PATELLA_CM_Z
inertia PATELLA_INERTIA_X 0.0 0.0
        0.0 PATELLA_INERTIA_Y 0.0
        0.0 0.0 PATELLA_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -0.001 0.0
endsegment

#if VARUS_VALGUS
beginsegment patella_vv_tmp_r
material my_bone
SHADOW_PARAMS
begingroups right leg_r knee_r endgroups
gait_scale R_SHANK SHANK_LENGTH SHANK_LENGTH SHANK_LENGTH
mass 0.0000001
masscenter 0.0 0.0 0.0
inertia 0.0000001 0.0 0.0
        0.0 0.0000001 0.0
        0.0 0.0 0.0000001
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -0.001 0.0
endsegment
#endif

beginsegment talus_r
bone talus_rv.asc
material my_bone
SHADOW_PARAMS
begingroups right leg_r foot_r ankle_r endgroups
gait_scale R_FOOT FOOT_LENGTH FOOT_LENGTH FOOT_LENGTH
mass TALUS_MASS
masscenter TALUS_CM_X TALUS_CM_Y TALUS_CM_Z
inertia TALUS_INERTIA_X 0.0 0.0
        0.0 TALUS_INERTIA_Y 0.0
        0.0 0.0 TALUS_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -0.001 0.0
endsegment

beginsegment foot_r
bone calcaneous_rv.asc
bone navicular_rv.asc
bone cuboid_rv.asc
bone first_cuneiform_rv.asc
bone second_cuneiform_rv.asc
bone third_cuneiform_rv.asc
bone metatarsal1_rv.asc
bone metatarsal2_rv.asc
bone metatarsal3_rv.asc
bone metatarsal4_rv.asc
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```
bone metatarsal5_rv.asc
material my_bone
SHADOW_PARAMS
begingroups right leg_r ankle_r foot_r endgroups
gait_scale R_FOOT FOOT_LENGTH FOOT_LENGTH FOOT_LENGTH
mass FOOT_MASS
masscenter FOOT_CM_X FOOT_CM_Y FOOT_CM_Z
inertia FOOT_INERTIA_X 0.0 0.0
        0.0 FOOT_INERTIA_Y 0.0
        0.0 0.0 FOOT_INERTIA_Z
force_matte right_foot r_shoe.asc
htr_o 0.0 0.0 0.0
htr_x 0.0 0.0 1.0
htr_y 1.0 0.0 0.0
endsegment

beginsegment foot_marker_r
material my_bone
SHADOW_PARAMS
begingroups right leg_r ankle_r foot_r endgroups
marker R.Toe  0.190 0.0 0.0 FOOT_WEIGHT
marker RTOE   0.190 0.0 0.0 FOOT_WEIGHT
marker RMET   0.190 0.0 0.0 FOOT_WEIGHT
marker R.MedFoot    0.13 0.0 -0.03 FOOT_WEIGHT
marker R.LatFoot    0.13 0.0 0.05 FOOT_WEIGHT
marker R.Toe.Med    0.13 0.0 -0.03 FOOT_WEIGHT
marker R.Toe.Lat    0.13 0.0 0.05 FOOT_WEIGHT
marker R.Midfoot.Lat    0.13 0.0 0.05 FOOT_WEIGHT
marker R.Midfoot.Sup    0.13 0.0 0.05 FOOT_WEIGHT
marker R.Heel 0.0 0.0 0.0 FOOT_WEIGHT
marker RHEE   0.0 0.0 0.0 FOOT_WEIGHT
marker RMT5   0.0 0.0 0.0 FOOT_WEIGHT
marker RHLT   0.0 0.0 0.0 FOOT_WEIGHT
gait_scale R_FOOT FOOT_LENGTH FOOT_LENGTH FOOT_LENGTH
mass 0.0
masscenter 0.0 0.0 0.0
inertia 0.0 0.0 0.0
        0.0 0.0 0.0
        0.0 0.0 0.0
htr_o 0.0 0.0 0.0
htr_x 0.0 0.0 1.0
htr_y 0.001 0.0 0.0
endsegment

beginsegment toes_r
bone prox_phalanx1_rvs.asc
bone prox_phalanx2_rvs.asc
bone prox_phalanx3_rvs.asc
bone prox_phalanx4_rvs.asc
bone prox_phalanx5_rvs.asc
bone mid_phalanx2_rvs.asc
bone mid_phalanx3_rvs.asc
bone mid_phalanx4_rvs.asc
bone mid_phalanx5_rvs.asc
bone distal_phalanx1_rvs.asc
bone distal_phalanx2_rvs.asc
bone distal_phalanx3_rvs.asc
bone distal_phalanx4_rvs.asc
bone distal_phalanx5_rvs.asc
material my_bone
SHADOW_PARAMS
begingroups right leg_r foot_r endgroups
gait_scale R_FOOT FOOT_LENGTH FOOT_LENGTH FOOT_LENGTH
mass TOES_MASS
masscenter TOES_CM_X TOES_CM_Y TOES_CM_Z
inertia TOES_INERTIA_X 0.0 0.0
        0.0 TOES_INERTIA_Y 0.0
        0.0 0.0 TOES_INERTIA_Z
htr_o 0.0 0.0 0.0
```

```
htr_x 0.0 0.0 1.0
htr_y 0.05 0.0 0.0
endsegment

beginsegment femur_l
bone femur_l.asc
material my_bone
SHADOW_PARAMS
begingroups left leg_l hip_l knee_l endgroups
marker L.Knee 0.0 -0.404 -0.05 OTHER_WEIGHT
marker L.Knee.Lateral    0.0 -0.404 -0.05 OTHER_WEIGHT
marker L.Knee.Lat    0.0 -0.404 -0.05 OTHER_WEIGHT
marker LKNE    0.0 -0.404 -0.05 OTHER_WEIGHT
marker LKNL    0.0 -0.404 -0.05 OTHER_WEIGHT
marker L.Knee.Medial     0.0 -0.404 0.05 OTHER_WEIGHT
marker L.Knee.Med    0.0 -0.404 0.05 OTHER_WEIGHT
marker L.Thigh      0.0179 -0.2240 -0.1147 OTHER_WEIGHT
marker L.Thigh.Upper      0.0179 -0.2640 -0.0647 OTHER_WEIGHT
marker L.Thigh.Front      0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Thigh.Rear -0.0479 -0.3240 -0.0047 OTHER_WEIGHT
marker LTBL   0.0179 -0.2240 -0.1147 OTHER_WEIGHT
marker LTBM   0.0179 -0.2640 -0.0647 OTHER_WEIGHT
marker LTTL   0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker LTTM  -0.0479 -0.3240 -0.0047 OTHER_WEIGHT
marker LTHI   0.0179 -0.2640 -0.0647 OTHER_WEIGHT
marker L.Thigh.M1   0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Thigh.M2   0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Thigh.M3   0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Femur.Medial     0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Femur.Lateral    0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Femur.Anterior   0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Femur.Posterior  0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Femur.Proximal   0.0800 -0.3240 -0.0047 OTHER_WEIGHT
marker L.Femur.Distal     0.0800 -0.3240 -0.0047 OTHER_WEIGHT
gait_scale L_THIGH THIGH_LENGTH THIGH_LENGTH THIGH_LENGTH
mass THIGH_MASS
masscenter THIGH_CM_X THIGH_CM_Y THIGH_CM_Z
inertia THIGH_INERTIA_X 0.0 0.0
        0.0 THIGH_INERTIA_Y 0.0
        0.0 0.0 THIGH_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -1.0 0.0
endsegment

#if VARUS_VALGUS
beginsegment tibia_l_pre
begingroups left leg_l knee_l ankle_l endgroups
gait_scale L_SHANK SHANK_LENGTH SHANK_LENGTH SHANK_LENGTH
mass 0.0000001
masscenter 0.0 0.0 0.0
inertia 0.0000001 0.0 0.0
        0.0 0.0000001 0.0
        0.0 0.0 0.0000001
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -0.001 0.0
endsegment
#endif

beginsegment tibia_l
bone tibia_l.asc
bone fibula_l.asc
material my_bone
SHADOW_PARAMS
begingroups left leg_l knee_l ankle_l endgroups
marker L.Ankle        -0.005 -0.41 -0.053 FOOT_WEIGHT
marker L.Ankle.Lateral    -0.005 -0.41 -0.053 FOOT_WEIGHT
marker L.Ankle.Lat  -0.005 -0.41 -0.053 FOOT_WEIGHT
```

```
marker LANK   -0.005 -0.41 -0.053 FOOT_WEIGHT
marker LMAL   -0.005 -0.41 -0.053 FOOT_WEIGHT
marker L.Ankle.Medial     0.006 -0.3888 0.038 FOOT_WEIGHT
marker L.Ankle.Med 0.006 -0.3888 0.038 FOOT_WEIGHT
marker L.Shank       0.0104 -0.2322 -0.0748 OTHER_WEIGHT
marker L.Shank.Upper     0.0125 -0.3196 -0.0600 OTHER_WEIGHT
marker L.Shank.Front     0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker L.Shank.Rear -0.0325 -0.3596 0.0000 OTHER_WEIGHT
marker LSBL   0.0104 -0.2322 -0.0748 OTHER_WEIGHT
marker LSBM   0.0125 -0.3196 -0.0600 OTHER_WEIGHT
marker LSTL   0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker LSTM   -0.0325 -0.3596 0.0000 OTHER_WEIGHT
marker LTIB   0.0125 -0.3196 -0.0600 OTHER_WEIGHT
marker L.Shank.M1   -0.008 -0.08 -0.055 OTHER_WEIGHT fixed /* fibular head
*/
marker L.Shank.M2   0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker L.Shank.M3   0.0425 -0.3596 0.0000 OTHER_WEIGHT fixed /* medial tibia
*/
marker L.Shank.M4   0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker L.Shank.M5   0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker L.Fibula.Head     0.0256 -0.04157 -0.05976 OTHER_WEIGHT fixed
marker L.Tibia.medial     0.02398 -0.05473 0.04540 OTHER_WEIGHT fixed
marker L.Tibia.tub 0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker L.Tibia.prox 0.0425 -0.3596 0.0000 OTHER_WEIGHT
marker L.Tibia.distal     0.0425 -0.3596 0.0000 OTHER_WEIGHT
gait_scale L_SHANK SHANK_LENGTH SHANK_LENGTH SHANK_LENGTH
mass SHANK_MASS
masscenter SHANK_CM_X SHANK_CM_Y SHANK_CM_Z
inertia SHANK_INERTIA_X 0.0 0.0
        0.0 SHANK_INERTIA_Y 0.0
        0.0 0.0 SHANK_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -1.0 0.0
endsegment

beginsegment patella_l
bone patella_l.asc
material my_bone
SHADOW_PARAMS
begingroups left leg_l knee_l endgroups
gait_scale L_SHANK SHANK_LENGTH SHANK_LENGTH SHANK_LENGTH
mass PATELLA_MASS
masscenter PATELLA_CM_X PATELLA_CM_Y PATELLA_CM_Z
inertia PATELLA_INERTIA_X 0.0 0.0
        0.0 PATELLA_INERTIA_Y 0.0
        0.0 0.0 PATELLA_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -0.001 0.0
endsegment

#if VARUS_VALGUS
beginsegment patella_vv_tmp_l
material my_bone
SHADOW_PARAMS
begingroups left leg_l knee_l endgroups
gait_scale L_SHANK SHANK_LENGTH SHANK_LENGTH SHANK_LENGTH
mass 0.0000001
masscenter 0.0 0.0 0.0
inertia 0.0000001 0.0 0.0
        0.0 0.0000001 0.0
        0.0 0.0 0.0000001
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -0.001 0.0
endsegment
#endif
```

```
beginsegment talus_l
bone talus_lv.asc
material my_bone
SHADOW_PARAMS
begingroups left leg_l foot_l ankle_l endgroups
gait_scale L_FOOT FOOT_LENGTH FOOT_LENGTH FOOT_LENGTH
mass TALUS_MASS
masscenter TALUS_CM_X TALUS_CM_Y TALUS_CM_Z
inertia TALUS_INERTIA_X 0.0 0.0
        0.0 TALUS_INERTIA_Y 0.0
        0.0 0.0 TALUS_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 1.0 0.0 0.0
htr_y 0.0 -0.001 0.0
endsegment

beginsegment foot_l
bone calcaneous_lv.asc
bone navicular_lv.asc
bone cuboid_lv.asc
bone first_cuneiform_lv.asc
bone second_cuneiform_lv.asc
bone third_cuneiform_lv.asc
bone metatarsal1_lv.asc
bone metatarsal2_lv.asc
bone metatarsal3_lv.asc
bone metatarsal4_lv.asc
bone metatarsal5_lv.asc
material my_bone
SHADOW_PARAMS
begingroups left leg_l ankle_l foot_l endgroups
gait_scale L_FOOT FOOT_LENGTH FOOT_LENGTH FOOT_LENGTH
mass FOOT_MASS
masscenter FOOT_CM_X FOOT_CM_Y FOOT_CM_Z
inertia FOOT_INERTIA_X 0.0 0.0
        0.0 FOOT_INERTIA_Y 0.0
        0.0 0.0 FOOT_INERTIA_Z
force_matte left_foot l_shoe.asc
htr_o 0.0 0.0 0.0
htr_x 0.0 0.0 1.0
htr_y 1.0 0.0 0.0
endsegment

beginsegment foot_marker_l
material my_bone
SHADOW_PARAMS
begingroups left leg_l ankle_l foot_l endgroups
marker L.Toe  0.190 0.0 0.0 FOOT_WEIGHT
marker LTOE   0.190 0.0 0.0 FOOT_WEIGHT
marker LMET   0.190 0.0 0.0 FOOT_WEIGHT
marker L.MedFoot    0.13 0.0 0.03 FOOT_WEIGHT
marker L.LatFoot    0.13 0.0 -0.05 FOOT_WEIGHT
marker L.Toe.Med    0.13 0.0 0.03 FOOT_WEIGHT
marker L.Toe.Lat    0.13 0.0 -0.05 FOOT_WEIGHT
marker L.Midfoot.Lat     0.13 0.0 0.03 FOOT_WEIGHT
marker L.Midfoot.Sup     0.13 0.0 -0.05 FOOT_WEIGHT
marker L.Heel 0.0 0.0 0.0 FOOT_WEIGHT
marker LHEE   0.0 0.0 0.0 FOOT_WEIGHT
marker LMT5   0.0 0.0 0.0 FOOT_WEIGHT
marker LHLT   0.0 0.0 0.0 FOOT_WEIGHT
gait_scale L_FOOT 0.267000 0.267000 0.267000
mass 0.0
masscenter 0.0 0.0 0.0
inertia 0.0 0.0 0.0
        0.0 0.0 0.0
        0.0 0.0 0.0
htr_o 0.0 0.0 0.0
htr_x 0.0 0.0 1.0
htr_y 0.001 0.0 0.0
```

```
endsegment

beginsegment toes_l
bone prox_phalanx1_lvs.asc
bone prox_phalanx2_lvs.asc
bone prox_phalanx3_lvs.asc
bone prox_phalanx4_lvs.asc
bone prox_phalanx5_lvs.asc
bone mid_phalanx2_lvs.asc
bone mid_phalanx3_lvs.asc
bone mid_phalanx4_lvs.asc
bone mid_phalanx5_lvs.asc
bone distal_phalanx1_lvs.asc
bone distal_phalanx2_lvs.asc
bone distal_phalanx3_lvs.asc
bone distal_phalanx4_lvs.asc
bone distal_phalanx5_lvs.asc
material my_bone
SHADOW_PARAMS
begingroups left leg_l foot_l endgroups
gait_scale L_FOOT 0.267000 0.267000 0.267000
mass TOES_MASS
masscenter TOES_CM_X TOES_CM_Y -TOES_CM_Z
inertia TOES_INERTIA_X 0.0 0.0
        0.0 TOES_INERTIA_Y 0.0
        0.0 0.0 TOES_INERTIA_Z
htr_o 0.0 0.0 0.0
htr_x 0.0 0.0 1.0
htr_y 0.05 0.0 0.0
endsegment


/*******************************************/
/*                 JOINTS                  */
/*******************************************/

beginjoint gnd_pelvis
segments ground pelvis
order t r1 r2 r3
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  function f1(lower_torso_TX)
ty  function f1(lower_torso_TY)
tz  function f1(lower_torso_TZ)
r1  function f1(lower_torso_RX)
r2  function f1(lower_torso_RY)
r3  function f1(lower_torso_RZ)
endjoint

beginjoint hip_r
segments pelvis femur_r
order t r3 r1 r2
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  constant -0.080000
ty  constant -0.082400
tz  constant 0.078500
r1  function f1(hip_add_r)
r2  function f1(hip_rot_r)
r3  function f1(hip_flex_r)
endjoint

#if VARUS_VALGUS

beginjoint knee_flexion_r
segments femur_r tibia_r
```

```
order t r3 r1 r2
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 -1.000000
tx  function f1600(knee_flex_r)
ty  function f1601(knee_flex_r)
tz  function f99(knee_flex_r)
r1  function f1(knee_vv_r)
r2  constant 0.000001
r3  function f1(knee_flex_r)
endjoint

beginjoint tib_pat_r
segments tibia_r patella_vv_tmp_r
order t r3 r1 r2
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  function f1602(knee_flex_r)
ty  function f1603(knee_flex_r)
tz  constant 0.002400
r1  constant 0.000000
r2  constant 0.000000
r3  function f1604(knee_flex_r)
endjoint

beginjoint patella_vv_corr_r
segments patella_vv_tmp_r patella_r
order t r1 r2 r3
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  constant 0.000000
ty  constant 0.000000
tz  constant 0.000000
r1  function f1612(knee_vv_r)
r2  constant 0.000000
r3  constant 0.000000
endjoint

#else

beginjoint knee_flexion_r
segments femur_r tibia_r
order t r3 r1 r2
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 -1.000000
tx  function f1600(knee_flex_r)
ty  function f1601(knee_flex_r)
tz  constant 0.0
r1  constant 0.0
r2  constant 0.0
r3  function f1(knee_flex_r)
endjoint

beginjoint tib_pat_r
segments tibia_r patella_r
order t r3 r1 r2
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  function f1602(knee_flex_r)
ty  function f1603(knee_flex_r)
tz  constant 0.002400
r1  constant 0.000000
r2  constant 0.000000
r3  function f1604(knee_flex_r)
endjoint
```

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```
#endif

beginjoint ankle_r
segments tibia_r talus_r
order t r3 r1 r2
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 -0.104529 -0.173649 0.979244
tx  constant 0.000000
ty  constant -0.426000
tz  constant 0.000000
r1  constant 0.000000
r2  constant 0.000000
r3  function f1(ankle_flex_r)
endjoint

beginjoint subtalar_r
segments talus_r foot_r
order t r1 r2 r3
axis1 0.787180 0.604747 -0.120949
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  constant -0.048770
ty  constant -0.041950
tz  constant 0.007920
r1  function f1(subt_angle_r)
r2  constant 0.000000
r3  constant 0.000000
endjoint

beginjoint foot_mark_r
segments foot_r foot_marker_r
order t r1 r2 r3
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  constant -0.020000
ty  constant 0.018000
tz  constant -0.010000
r1  constant 0.000000
r2  constant 0.000000
r3  constant 0.000000
endjoint

beginjoint toes_r
segments foot_r toes_r
order t r1 r2 r3
axis1 0.541717 0.000000 -0.840561
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  constant 0.176800
ty  constant -0.002000
tz  constant 0.001080
r1  function f1(toe_angle_r)
r2  constant 0.000000
r3  constant 0.000000
endjoint

beginjoint hip_l
segments pelvis femur_l
order t r3 r1 r2
axis1 -1.000000 0.000000 0.000000
axis2 0.000000 -1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  constant -0.080000
ty  constant -0.082400
tz  constant -0.078500
r1  function f1(hip_add_l)
```

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```
r2  function f1(hip_rot_l)
r3  function f1(hip_flex_l)
endjoint

#if VARUS_VALGUS

beginjoint knee_flexion_l_1
segments femur_l tibia_l_pre
order t r3 r1 r2
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  function f1700(knee_flex_l)
ty  function f1701(knee_flex_l)
tz  constant 0.0
r1  constant 0.0
r2  constant 0.0
r3  constant 0.000001
endjoint

beginjoint knee_flexion_l_2
segments tibia_l_pre tibia_l
order t r3 r1 r2
axis1 -1.000000 0.000000 0.000000
axis2 0.000000 -1.000000 0.000000
axis3 0.000000 0.000000 -1.000000
tx  constant 0.0
ty  constant 0.0
tz  constant 0.0
r1  function f1(knee_vv_l)
r2  constant 0.0
r3  function f1(knee_flex_l)
endjoint

beginjoint tib_pat_l
segments tibia_l patella_vv_tmp_l
order t r3 r1 r2
axis1 -1.000000 0.000000 0.000000
axis2 0.000000 -1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  function f1702(knee_flex_l)
ty  function f1703(knee_flex_l)
tz  constant -0.002400
r1  constant 0.000000
r2  constant 0.000000
r3  function f1704(knee_flex_l)
endjoint

beginjoint patella_vv_corr_l
segments patella_vv_tmp_l patella_l
order t r1 r2 r3
axis1 -1.000000 0.000000 0.000000
axis2 0.000000 -1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx  constant 0.000000
ty  constant 0.000000
tz  constant 0.000000
r1  function f1612(knee_vv_l)
r2  constant 0.000000
r3  constant 0.000000
endjoint

#else

beginjoint knee_flexion_l
segments femur_l tibia_l
order t r3 r1 r2
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
```

```
axis3 0.000000 0.000000 -1.000000
tx   function f1700(knee_flex_l)
ty   function f1701(knee_flex_l)
tz   constant 0.0
r1   constant 0.0
r2   constant 0.0
r3   function f1(knee_flex_l)
endjoint

beginjoint tib_pat_l
segments tibia_l patella_l
order t r3 r1 r2
axis1 -1.000000 0.000000 0.000000
axis2 0.000000 -1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx   function f1702(knee_flex_l)
ty   function f1703(knee_flex_l)
tz   constant -0.002400
r1   constant 0.000000
r2   constant 0.000000
r3   function f1704(knee_flex_l)
endjoint

#endif

beginjoint ankle_l
segments tibia_l talus_l
order t r3 r1 r2
axis1 -1.000000 0.000000 0.000000
axis2 0.000000 -1.000000 0.000000
axis3 0.104529 0.173649 0.979244
tx   constant 0.000000
ty   constant -0.426000
tz   constant 0.000000
r1   constant 0.000000
r2   constant 0.000000
r3   function f1(ankle_flex_l)
endjoint

beginjoint subtalar_l
segments talus_l foot_l
order t r1 r2 r3
axis1 -0.787180 -0.604747 -0.120949
axis2 0.000000 -1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx   constant -0.048770
ty   constant -0.041950
tz   constant -0.007920
r1   function f1(subt_angle_l)
r2   constant 0.000000
r3   constant 0.000000
endjoint

beginjoint foot_mark_l
segments foot_l foot_marker_l
order t r1 r2 r3
axis1 1.000000 0.000000 0.000000
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx   constant -0.020000
ty   constant 0.018000
tz   constant 0.010000
r1   constant 0.000000
r2   constant 0.000000
r3   constant 0.000000
endjoint

beginjoint toes_l
segments foot_l toes_l
```

```
order t r1 r2 r3
axis1 -0.541717 0.000000 -0.840561
axis2 0.000000 1.000000 0.000000
axis3 0.000000 0.000000 1.000000
tx   constant 0.176800
ty   constant -0.002000
tz   constant -0.001080
r1   function f1(toe_angle_l)
r2   constant 0.000000
r3   constant 0.000000
endjoint




/********************************************/
/*                GENCOORDS                 */
/********************************************/

begingencoord lower_torso_TX
range -10.000000 10.000000
#if GROUND_PLANE_XZ
#elif GROUND_PLANE_XY
#elif GROUND_PLANE_YZ
   default_value 0.969
#endif
begingroups ground_LT endgroups
clamped no
visible no
pd_stiffness PD_OTHER
endgencoord

begingencoord lower_torso_TY
range -10.000000 10.000000
#if GROUND_PLANE_XZ
   default_value 0.969
#elif GROUND_PLANE_XY
#elif GROUND_PLANE_YZ
#endif
begingroups ground_LT endgroups
clamped no
visible no
pd_stiffness PD_OTHER
endgencoord

begingencoord lower_torso_TZ
range -10.000000 10.000000
#if GROUND_PLANE_XZ
#elif GROUND_PLANE_XY
   default_value 0.969
#elif GROUND_PLANE_YZ
#endif
begingroups ground_LT endgroups
clamped no
visible no
pd_stiffness PD_OTHER
endgencoord

begingencoord lower_torso_RX
range -270.000000 270.000000
#if GROUND_PLANE_XZ
#elif GROUND_PLANE_XY
   default_value 90.0
#elif GROUND_PLANE_YZ
#endif
begingroups ground_LT endgroups
clamped no
pd_stiffness PD_OTHER
endgencoord
```

```
begingencoord lower_torso_RY
range -270.000000 270.000000
#if GROUND_PLANE_XZ
#elif GROUND_PLANE_XY
#elif GROUND_PLANE_YZ
    default_value -90.0
#endif
begingroups ground_LT endgroups
clamped no
pd_stiffness PD_OTHER
endgencoord

begingencoord lower_torso_RZ
range -270.000000 270.000000
#if GROUND_PLANE_XZ
#elif GROUND_PLANE_XY
#elif GROUND_PLANE_YZ
    default_value -90.0
#endif
begingroups ground_LT endgroups
clamped no
pd_stiffness PD_OTHER
endgencoord

begingencoord hip_flex_r
range -11.000000 95.000000
begingroups right leg_r hip_r endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_OTHER
endgencoord

begingencoord hip_add_r
range -50.000000 20.000000
begingroups right leg_r hip_r endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_OTHER
endgencoord

begingencoord hip_rot_r
range -40.000000 40.000000
begingroups right leg_r hip_r endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_OTHER
endgencoord

begingencoord knee_flex_r
range -10.000000 120.000000
begingroups right leg_r knee_r endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_KNEE
endgencoord

#if VARUS_VALGUS
begingencoord knee_vv_r
range -25.000000 25.000000
begingroups right leg_r knee_r endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_KNEE
endgencoord
```

```
#endif

begingencoord ankle_flex_r
range -30.000000 30.000000
begingroups right leg_r ankle_r endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_ANKLE
endgencoord

begingencoord subt_angle_r
range -20.000000 20.000000
begingroups right leg_r ankle_r endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_ANKLE
endgencoord

begingencoord toe_angle_r
range -30.000000 30.000000
begingroups right leg_r toes_r endgroups
minrestraint f43
maxrestraint f43
clamped yes
visible no
pd_stiffness PD_OTHER
endgencoord

begingencoord hip_flex_l
range -11.000000 95.000000
begingroups left leg_l hip_l endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_OTHER
endgencoord

begingencoord hip_add_l
range -50.000000 20.000000
begingroups left leg_l hip_l endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_OTHER
endgencoord

begingencoord hip_rot_l
range -40.000000 40.000000
begingroups left leg_l hip_l endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_OTHER
endgencoord

begingencoord knee_flex_l
range -10.000000 120.000000
begingroups left leg_l knee_l endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_KNEE
endgencoord

#if VARUS_VALGUS
begingencoord knee_vv_l
range -25.000000 25.000000
```

```
begingroups left leg_l knee_l endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_KNEE
endgencoord
#endif

begingencoord ankle_flex_l
range -30.000000 30.000000
begingroups left leg_l ankle_l endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_ANKLE
endgencoord

begingencoord subt_angle_l
range -20.000000 20.000000
begingroups left leg_l ankle_l endgroups
minrestraint f43
maxrestraint f43
clamped yes
pd_stiffness PD_ANKLE
endgencoord

begingencoord toe_angle_l
range -30.000000 30.000000
begingroups left leg_l toes_l endgroups
minrestraint f43
maxrestraint f43
clamped yes
visible no
pd_stiffness PD_OTHER
endgencoord


/********************************************/
/*                  FUNCTIONS               */
/********************************************/

beginfunction f1
(-360.000000,-360.000000)
( 360.000000, 360.000000)
endfunction

beginfunction f99
(-360.0, 0.0)
( 360.0, 0.0)
endfunction

beginfunction f1600
(    0.000000,   -0.005250)
(   10.000000,   -0.003100)
(   20.000000,   -0.001000)
(   40.000000,    0.002120)
(   60.000000,    0.004100)
(   80.000000,    0.004110)
(  100.000000,    0.001790)
(  120.000000,   -0.003200)
endfunction

beginfunction f1601
(    0.000000,   -0.396000)
(   10.000000,   -0.396600)
(   20.000000,   -0.397600)
(   30.000000,   -0.399000)
(   70.000000,   -0.408200)
(  120.000000,   -0.422600)
```

```
        endfunction

        beginfunction f1602
        (    0.000000,    0.049600)
        (   10.000000,    0.048400)
        (   20.000000,    0.046900)
        (   40.000000,    0.043000)
        (   60.000000,    0.038100)
        (   80.000000,    0.032400)
        (  120.000000,    0.017300)
        endfunction

        beginfunction f1603
        (    0.286000,   -0.022700)
        (   10.000000,   -0.022300)
        (   20.000000,   -0.021900)
        (   40.000000,   -0.021100)
        (   60.000000,   -0.020400)
        (   80.000000,   -0.020000)
        (   90.000000,   -0.020200)
        (  120.000000,   -0.021900)
        endfunction

        beginfunction f1604
        (  -10.000000,   -9.240000)
        (   -0.150000,   -2.440000)
        (   20.340000,    6.090000)
        (   56.430000,   13.860000)
        (  114.590000,   17.650000)
        (  120.000000,   17.650000)
        endfunction

        beginfunction f1612
        (  -15.000000,   15.000000)
        (  -10.000000,   10.000000)
        (   -5.000000,    5.000000)
        (    0.000000,    0.000000)
        (    5.000000,   -5.000000)
        (   10.000000,  -10.000000)
        (   15.000000,  -15.000000)
        endfunction

        beginfunction f1700
        (    0.000000,   -0.005250)
        (   10.000000,   -0.003100)
        (   20.000000,   -0.001000)
        (   40.000000,    0.002120)
        (   60.000000,    0.004100)
        (   80.000000,    0.004110)
        (  100.000000,    0.001790)
        (  120.000000,   -0.003200)
        endfunction

        beginfunction f1701
        (    0.000000,   -0.396000)
        (   10.000000,   -0.396600)
        (   20.000000,   -0.397600)
        (   30.000000,   -0.399000)
        (   70.000000,   -0.408200)
        (  120.000000,   -0.422600)
        endfunction

        beginfunction f1702
        (    0.000000,    0.049600)
        (   10.000000,    0.048400)
        (   20.000000,    0.046900)
        (   40.000000,    0.043000)
        (   60.000000,    0.038100)
        (   80.000000,    0.032400)
```

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```
( 120.000000,   0.017300)
endfunction

beginfunction f1703
(    0.286000,  -0.022700)
(   10.000000,  -0.022300)
(   20.000000,  -0.021900)
(   40.000000,  -0.021100)
(   60.000000,  -0.020400)
(   80.000000,  -0.020000)
(   90.000000,  -0.020200)
( 120.000000,  -0.021900)
endfunction

beginfunction f1704
(  -10.000000,  -9.240000)
(   -0.150000,  -2.440000)
(   20.340000,   6.090000)
(   56.430000,  13.860000)
(  114.590000,  17.650000)
(  120.000000,  17.650000)
endfunction

beginfunction f43
(  0.000000,   0.000000)
( 10.000000,  20.000000)
( 30.000000,  70.000000)
endfunction

/*******************************************/
/*           MATERIALS AND COLORS          */
/*******************************************/

beginmaterial my_bone
ambient 0.6000 0.6000 0.6000
diffuse 0.6000 0.4500 0.4000
specular 0.7000 0.5500 0.4000
shininess 10.0000
endmaterial

beginmaterial cyan
ambient 0.1000 0.8000 1.0000
diffuse 0.1000 0.3000 0.5000
specular 0.1000 0.3000 0.5000
shininess 10.0000
endmaterial

beginmaterial green
ambient 0.0100 0.9000 0.0100
diffuse 0.1000 0.9000 0.1000
specular 0.5000 0.5000 0.5000
shininess 10.0000
endmaterial

beginmaterial orange
ambient 1.0000 0.3000 0.0100
diffuse 0.5000 0.1000 0.1000
specular 0.5000 0.5000 0.5000
shininess 10.0000
endmaterial

beginmaterial yellow
ambient 1.0000 0.8000 0.1000
diffuse 0.5000 0.4000 0.1000
specular 0.5000 0.4000 0.1000
shininess 10.0000
endmaterial

beginmaterial purple
```

```
ambient 0.5000 0.0100 0.5000
diffuse 0.5000 0.0100 0.5000
specular 0.5000 0.5000 0.5000
shininess 10.0000
endmaterial

beginmaterial blue
ambient 0.1000 0.1000 1.0000
diffuse 0.1000 0.1000 1.0000
specular 0.5000 0.5000 0.5000
shininess 10.0000
endmaterial

beginmaterial pink
ambient 0.9000 0.3000 0.2000
diffuse 0.2000 0.3000 0.2000
specular 0.1400 0.0000 0.2000
shininess 25.0000
endmaterial

beginmaterial tan
ambient 0.7000 0.4000 0.1000
diffuse 0.2000 0.3000 0.2000
specular 0.1400 0.0000 0.2000
shininess 10.0000
endmaterial

beginmaterial red
ambient 1.0000 0.1000 0.1000
diffuse 0.5000 0.1000 0.1000
specular 0.5000 0.1000 0.1000
shininess 10.0000
endmaterial

beginmaterial arrow_mat
ambient 0.4000 0.4000 0.7000
diffuse 0.3000 0.3000 0.5000
specular 0.3000 0.3000 0.5000
shininess 0.0000
endmaterial

beginmaterial ligament_mat
ambient 0.8000 0.3000 0.3000
diffuse 0.7000 0.2000 0.2000
specular 1.0000 0.5000 0.5000
shininess 20.0000
endmaterial

beginmaterial bone_mat
ambient 0.6000 0.6000 0.6000
diffuse 0.6000 0.4500 0.4000
specular 0.7000 0.5500 0.4000
shininess 10.0000
endmaterial

beginmaterial goldmetal
ambient 0.4000 0.2000 0.0000
diffuse 0.2200 0.1800 0.0500
specular 0.8000 0.8000 0.4000
shininess 93.0000
endmaterial

beginmaterial graymetal
ambient 0.2000 0.2000 0.2000
diffuse 0.0500 0.0500 0.0500
specular 1.0000 1.0000 1.0000
shininess 95.0000
endmaterial
```

```
beginmaterial rad_bone
ambient 0.6000 0.6000 0.8000
diffuse 0.6000 0.4500 0.7000
specular 0.9000 0.4000 0.4000
shininess 20.0000
endmaterial

beginmaterial dist_bone
ambient 0.6000 0.6000 0.8000
diffuse 0.6000 0.4500 0.7000
specular 0.9000 0.4000 0.4000
shininess 20.0000
endmaterial

beginmaterial floor_material
ambient 0.5000 0.4000 0.3000
diffuse 0.5000 0.4000 0.3000
specular 0.5000 0.4000 0.3000
endmaterial


/********************************************/
/*              MOTIONOBJECTS               */
/********************************************/

beginmotionobject ball
material blue
scale 0.25 0.25 0.25
endmotionobject

beginmotionobject joint_force
 filename arrow.asc
 scale 1.0 0.003 1.0
 material blue
 vectoraxis y
endmotionobject

/********************************************/
/*              WORLDOBJECTS                */
/********************************************/

#if GROUND_PLANE_XZ
        #define FLOOR floor_xz_plane.asc
        #define FLOOR_ORIGIN 0.0 -0.002 0.0
#elif GROUND_PLANE_XY
        #define FLOOR floor_xy_plane.asc
        #define FLOOR_ORIGIN 0.0 0.0 -0.002
#elif GROUND_PLANE_YZ
        #define FLOOR floor_yz_plane.asc
        #define FLOOR_ORIGIN -0.002 0.0 0.0
#endif

beginworldobject floor
filename FLOOR
material floor_material
origin FLOOR_ORIGIN
drawmode solid_fill
endworldobject


/********************************************/
/*              CAMERAS                     */
/********************************************/

#if GROUND_PLANE_XZ
        beginview default
         0.0   0.0   1.0   0.0
         0.0   1.0   0.0   0.0
        -1.0   0.0   0.0   0.0
```

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```
               0.0 -1.0 -5.0  1.0
               endview

               beginview motion
              -0.7046 -0.0060  0.7096 0.0000
               0.0366  0.9983  0.0448 0.0000
              -0.7087  0.0575 -0.7032 0.0000
               0.3181 -0.8978 -4.5020 1.0000
               endview

               beginview front
                0.0  0.0   1.0  0.0
                0.0  1.0   0.0  0.0
               -1.0  0.0   0.0  0.0
                0.0 -1.0 -5.0  1.0
               endview

               beginview side
                1.0  0.0   0.0  0.0
                0.0  1.0   0.0  0.0
                0.0  0.0   1.0  0.0
                0.0 -1.0 -5.0  1.0
               endview

               beginview top
               1.0  0.0   0.0  0.0
               0.0  0.0   1.0  0.0
               0.0 -1.0   0.0  0.0
               0.0  0.0 -5.0  1.0
               endview

#elif GROUND_PLANE_XY
               beginview default
               0.0  0.0   1.0  0.0
               1.0  0.0   0.0  0.0
               0.0  1.0   0.0  0.0
               0.0 -1.0 -5.0  1.0
               endview

               beginview motion
              -0.3906 -0.0806  0.9170  0.0000
               0.9205 -0.0301  0.3895  0.0000
              -0.0038  0.9963  0.0860  0.0000
               0.5573 -1.0410 -3.6453  1.0000
               endview

               beginview front
               0.0  0.0   1.0  0.0
               1.0  0.0   0.0  0.0
               0.0  1.0   0.0  0.0
               0.0 -1.0 -5.0  1.0
               endview

               beginview side
                1.0  0.0   0.0  0.0
                0.0  0.0  -1.0  0.0
                0.0  1.0   0.0  0.0
                0.0 -1.0 -5.0  1.0
               endview

               beginview top
                1.0   0.0   0.0  0.0
                0.0   1.0   0.0  0.0
                0.0   0.0   1.0  0.0
                0.0   0.0 -5.0  1.0
               endview

#elif GROUND_PLANE_YZ
               beginview default
```

```
      0.0  1.0    0.0   0.0
     -1.0  0.0    0.0   0.0
      0.0  0.0    1.0   0.0
      0.0 -0.5   -5.0   1.0
     endview

     beginview motion
     -0.0016  0.9994 -0.0347 0.0000
     -0.7450 -0.0243 -0.6666 0.0000
     -0.6670  0.0248  0.7446 0.0000
      0.5645 -0.8547 -6.0538 1.0000
     endview

     beginview front
     0.0  1.0    0.0   0.0
    -1.0  0.0    0.0   0.0
     0.0  0.0    1.0   0.0
     0.0 -0.5   -5.0   1.0
     endview

     beginview side
      0.0  1.0    0.0   0.0
      0.0  0.0    1.0   0.0
      1.0  0.0    0.0   0.0
      0.0 -0.5   -5.0   1.0
     endview

     beginview top
      0.0  0.0    1.0   0.0
      0.0 -1.0    0.0   0.0
      1.0  0.0    0.0   0.0
      0.0  0.0   -5.0   1.0
     endview
#endif
```