APPENDIX C – SAMPLE ANIMATION SCRIPT

```
#---------------------------------------------------------------------------
#
# file: human-walk-trials.script
#
# Script to perform basic walking trials
#
#   Perform balance trials with up vector RVs
#   Trials use Q_d from [0.1,0] to [0.5,0] (Q_d = [Q_d_fwd,Q_d_lat])
#
# balance <#strides> <Q_tol1> <K1_max> <K1_sample> <RV1>:<elem1>   \
#                    <Q_tol2> <K2_max> <K2_sample> <RV2>:<elem2>
#
#     <max_strides>    - desired # of strides
#
#     <Q1_tol>         - max. tolerable error in Q for 1st control dimension
#     <K1_max>         - max final perturbation scaling (dim 1)
#     <K1_sample>      - sample scalings (+/- K1_sample) (dim 1)
#     <RV>:<elem>      - RV type and component
#                          type:
#                              0 -> up vector
#                              1 -> stance-COM vector
#                              2 -> swing-COM vector
#
#                          component of RV
#                              0 -> forward component
#                              1 -> lateral component
#
#     <Q_tol2>, <K2_max>, <K2_sample>, <RV2>, <elem2> as above but for 2nd
#     control dimension.
#
#---------------------------------------------------------------------------


< human.bones

set kfspring 25000                                    # floor stiffness (Kp)
set kfdamp    1500                                    # floor stiffness (Kd)

set sddt 0.00025                                      # simulation time-step


# base PCG for walking

set pcstates 6

posecycle poses 0
5 0 0   0 -50 0 60 -5 0   0 -10 0  0  0 0     7  0  -3  0    5    5 # r-foot
5 0 0   0 -50 0 60 -5 0   0 -10 0  0  0 0     7  0 -12  0        .2
5 0 0   0 -20 0  0  5 0   0 -10 0  0  0 0     7  0 -12 -7        .2
5 0 0   0 -10 0  0  0 0   0 -50 0 60 -5 0    -3  0   7  0    4    5 # l-foot
5 0 0   0 -10 0  0  0 0   0 -50 0 60 -5 0   -12  0   7  0        .2
5 0 0   0 -10 0  0  0 0   0 -20 0  0  5 0   -12 -7   7  0        .2

set hinit 0,0,0,0,0,0,0,0,0,-5.1,-20,0,50,0,0,0,0,0,0 # initial pose
                                                      # all velocities are 0
```

```
# ----- forward then lateral (F-L) 2d control


# hip pitch perturbations:

posecycle poses 1                                       # right hip pitch
0 0 0    0 0 0 0 0 0    0 1 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 1 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 1 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0

posecycle poses 2                                       # left hip pitch
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 1 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 1 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 1 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0


# hip roll perturbations:

posecycle poses 3                                       # right hip roll
0 0 0    0 0 0 0 0 0    1 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    1 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    1 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0

posecycle poses 4                                       # left hip roll
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    1 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    1 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    1 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0


# balance trials

set showfile basic-walk_upvect_FL_Q=[.1,0].out
set Q_d 0.1,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_FL_Q=[.15,0].out
set Q_d 0.15,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_FL_Q=[.2,0].out
set Q_d 0.2,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_FL_Q=[.25,0].out
set Q_d 0.25,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile tbasic-walk_upvect_FL_Q=[.3,0].out
set Q_d 0.3,0
```

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balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_FL_Q=[.35,0].out
set Q_d 0.35,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_FL_Q=[.4,0].out
set Q_d 0.4,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_FL_Q=[.45,0].out
set Q_d 0.45,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_FL_Q=[.5,0].out
set Q_d 0.5,0
balance 30 1 180 5 0:0 1 180 1 0:1



# ----- superposition (SP) 2d control
#
# Use same perturbations as F-L since order of
# perturbations doesn't matter for superpos.


# balance trials

set superposition true

set showfile basic-walk_upvect_SP_Q=[.1,0].out
set Q_d 0.1,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_SP_Q=[.15,0].out
set Q_d 0.15,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_SP_Q=[.2,0].out
set Q_d 0.2,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_SP_Q=[.25,0].out
set Q_d 0.25,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile tbasic-walk_upvect_SP_Q=[.3,0].out
set Q_d 0.3,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_SP_Q=[.35,0].out
set Q_d 0.35,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_SP_Q=[.4,0].out
set Q_d 0.4,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_SP_Q=[.45,0].out
set Q_d 0.45,0
balance 30 1 180 5 0:0 1 180 1 0:1

set showfile basic-walk_upvect_SP_Q=[.5,0].out
set Q_d 0.5,0
```

```
balance 30 1 180 5 0:0 1 180 1 0:1

set superposition false


# ----- lateral then forward (L-F) 2D control


# hip roll perturbations:

posecycle poses 1                                          # right hip roll
0 0 0    0 0 0 0 0 0    1 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    1 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    1 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0

posecycle poses 2                                          # left hip roll
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    1 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    1 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    1 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0


# hip roll perturbations:

posecycle poses 3                                          # right hip pitch
0 0 0    0 0 0 0 0 0    0 1 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 1 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 1 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0

posecycle poses 4                                          # left hip pitch
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 0 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 1 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 1 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0
0 0 0    0 1 0 0 0 0    0 0 0 0 0 0   0 0   0 0   0


# balance trials

set showfile basic-walk_upvect_LF_Q=[.1,0].out
set Q_d 0.1,0
balance 30 1 180 1 0:1 1 180 5 0:0

set showfile tbasic-walk_upvect_LF_Q=[.15,0].out
set Q_d 0.15,0
balance 30 1 180 1 0:1 1 180 5 0:0

set showfile basic-walk_upvect_LF_Q=[.2,0].out
set Q_d 0.2,0
balance 30 1 180 1 0:1 1 180 5 0:0

set showfile basic-walk_upvect_LF_Q=[.25,0].out
set Q_d 0.25,0
balance 30 1 180 1 0:1 1 180 5 0:0
```

```
set showfile tbasic-walk_upvect_LF_Q=[.3,0].out
set Q_d 0.3,0
balance 30 1 180 1 0:1 1 180 5 0:0

set showfile basic-walk_upvect_LF_Q=[.35,0].out
set Q_d 0.35,0
balance 30 1 180 1 0:1 1 180 5 0:0

set showfile basic-walk_upvect_LF_Q=[.4,0].out
set Q_d 0.4,0
balance 30 1 180 1 0:1 1 180 5 0:0

set showfile basic-walk_upvect_LF_Q=[.45,0].out
set Q_d 0.45,0
balance 30 1 180 1 0:1 1 180 5 0:0

set showfile basic-walk_upvect_LF_Q=[.5,0].out
set Q_d 0.5,0
balance 30 1 180 1 0:1 1 180 5 0:0
```