walker_simult.mdl

```
////////////////////////////////////////////////////////////////////
 Altair HyperWorks

 Version : HWVERSION_9.0b105_Feb  9 2008_22:53:19

 Model : The Model

 Customer ID :

 Date : 06/23/08 18:49:26
////////////////////////////////////////////////////////////////////

*BeginMDL(the_model, "The Model", "9.0b105" )

  *SetCurrentSolverMode(MotionSolve)
  *Point( p_0, "Point 0" )
  *Point( p_1, "Point 1" )
  *Point( p_2, "Point 2" )
  *Body( b_0, "Body 0", p_0 )
  *Body( b_1, "Body 1", p_1 )
  *Body( b_2, "Body 2", p_2 )
  *Body( b_3, "Body 3", P_Global_Origin )
  *Graphic( gra_0, "Graphic 0", CYLINDER, b_0, p_0, MODEL.p_2, 0.005,
gra_0.r1, , 0.0, CAPBOTH )
  *Graphic( gra_2, "Graphic 3", BOX, b_3, CENTER, P_Global_Origin, ZX,
MODEL.V_Global_Z, MODEL.V_Global_X, 2.8, 1, 0.02 )
  *Graphic( gra_1, "Graphic 1", CYLINDER, b_1, p_1, MODEL.p_2, 0.005,
gra_1.r1, , 0.0, CAPBOTH )
  *RevJoint( j_1, "Joint 02", MODEL.b_0, MODEL.b_2, MODEL.p_2,
MODEL.V_Global_Y )
  *RevJoint( j_2, "Joint 12", MODEL.b_1, MODEL.b_2, MODEL.p_2,
MODEL.V_Global_Y )
  *Sensor( sen_0, "b0_z" )
  *Sensor( sen_1, "b1_z" )
  *Template( tmplt_0, "commandset", SOLVER_COMMAND, def_tmplt_0 )
  *Contact( con_0, "Contact 0", POISSON, ON, 1, MODEL.gra_0, false, 1,
MODEL.gra_2, false )
  *Contact( con_1, "Contact 1", POISSON, ON, 1, gra_1, false, 1, gra_2,
false )
  *RevJoint( j_3, "Joint 13", b_1, MODEL.b_3, p_1, MODEL.V_Global_Y )
  *Sensor( sen_2, "dx_b0_b1" )
  *Sensor( sen_3, "b2_vz" )
  *Marker( m_0, "Marker 0", MODEL.b_0, MODEL.p_0, FLOATING )
  *Marker( m_1, "Marker 1", MODEL.b_1, MODEL.p_1, FLOATING )
  *Marker( m_2, "Marker 2", b_3, p_0, FLOATING )
  *Marker( m_3, "Marker 3", b_3, p_1, FLOATING )
  *Output( o_0, "Output 0", EXPR,
`FZ({the_model.m_1.idstring},{the_model.Global_Frame.idstring})`, `0`,
`0`, `0`, `0`, `0` )
  *Sensor( sen_4, "b1_b3_fz" )
  *FixedJoint( j_0, "Joint 3G", b_3, B_Ground, P_Global_Origin )
  *Template( tmplt_1, "model_statement", SOLVER_INPUT, def_tmplt_1 )
```

```
 *DefineTemplate( def_tmplt_0 )
 <H3DOutput
    switch_on           = "TRUE"
    increment           = "1"
    start_time          = "0."
    end_time            = "9999999."
    format_option       = "AUTO"
    stress_option       = "TENSOR"
    strain_option       = "TENSOR"
 />

 <Param_Simulation
    constr_tol          = "1.0000E-10"
    implicit_diff_tol   = "1.0000E-06"
 />

 <Param_Transient
    integr_tol          = "0.0001"
    integrator_type     = "DSTIFF"
    h_max               = "0.01"
    h0_max              = "0.001"
 />

 <Deactivate
    element_type        = "SENSOR"
    element_id          = "301001"
 />

<Deactivate
    element_type        = "SENSOR"
    element_id          = "301002"
/>

<Deactivate
    element_type        = "SENSOR"
    element_id          = "301003"
/>

<Deactivate
    element_type        = "SENSOR"
    element_id          = "301005"
/>

<Deactivate
    element_type = "CONTACT"
    element_id = "301001"
/>

<Deactivate
    element_type = "CONTACT"
    element_id = "301002"
/>

<Deactivate
    element_type = "JOINT"
    element_id = "301005"
/>
```

```
<Deactivate
     element_type = "JOINT"
     element_id = "301006"
 />

<Simulate
     analysis_type       = "Transient"
     end_time            = "15."
     print_interval      = "0.01"
/>



<Deactivate
     element_type        = "SENSOR"
     element_id          = "301004"
/>

 {if (the_model.b_1.vx == 0)}

 <Activate
     element_type        = "SENSOR"
     element_id          = "301003"
 />

 <Simulate
     analysis_type       = "Transient"
     end_time            = "15."
     print_interval      = "0.01"
 />



 <Deactivate
     element_type        = "SENSOR"
     element_id          = "301003"
 />

 <Activate
     element_type        = "SENSOR"
     element_id          = "301001"
 />

 <Simulate
     analysis_type       = "Transient"
     end_time            = "15."
     print_interval      = "0.01"
 />



 <Deactivate
     element_type        = "SENSOR"
```

```
    element_id          = "301001"
 />

 <Activate
    element_type = "JOINT"
    element_id = "301005"
 />

 <Deactivate
    element_type = "JOINT"
    element_id = "301003"
 />

 <Simulate
    analysis_type       = "Transient"
    end_time            = "15"
    print_interval      = "0.01"
 />

{endif}  *EndDefine()

  *DefineTemplate( def_tmplt_1 )
<Constraint_Joint
     id                 = "301005"
     type               = "REVOLUTE"
     i_marker_id        = "30102021"
     j_marker_id        = "30105020"
     align_meth1        = "VECTOR"
     align_vec1         = "V_Global_Y"
/>

<Constraint_Joint
     id                 = "301006"
     type               = "REVOLUTE"
     i_marker_id        = "30103032"
     j_marker_id        = "30105031"
     align_meth1        = "VECTOR"
     align_vec1         = "V_Global_Y"
/>  *EndDefine()

  ////////////////////////////////////////////////////////////
  *SetSystem( MODEL )  //The Model

  *SetOption( DS_Units.op_length,         "METER" )
  *Set( b_0.usecm, true )
  *SetBodyInertia( b_0,                        1.0 )
  *SetBodyICFlag( b_0,                        false )
  *Set( b_1.usecm, true )
  *SetBodyInertia( b_2,                        1000.0 )
  *Set( b_2.usecm, true )
  *Set( b_3.usecm, true )
  *SetBodyInertia( b_1,                        1 )
  *Set( gra_2.is_material_inside, true )
  *SetSensor( sen_0,                      USER, `USER()`, 0.0, EQ, 0.0,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, NO_RETURN, OFF,
NO_YYDUMP )
  *SetSensor( sen_0,                      LIN, , 0.0, EQ, 0.0,
```

```
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, NO_RETURN, OFF,
NO_YYDUMP )
  *SetNote( sen_0,                      )
  *SetSensor( sen_1,                      LIN, , 0.02, LE, -1e-8,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN, OFF, NO_YYDUMP )
  *SetEntityId( sen_0,                      301001 )
  *SetEntityId( sen_1,                      301002 )
  *SetEntityNumber( con_1,                      DEFAULT )
  *SetSensorEvaluate( sen_1,                      LIN )
  *Set( sen_1.do_evaluate, false )
  *SetEntityId( gra_0,                      90001 )
  *SetEntityId( gra_2,                      DEFAULT )
  *SetEntityId( gra_1,                      DEFAULT )
  *SetNote( j_3,                      )
  *SetJointICFlag( j_3,                         ROT, false )
  *SetBodyIC( b_3,                        , , , , 0.0 )
  *SetPoint( p_1,                       -1.1, , 0.01 )
  *SetPoint( p_2,                       -1.1 - sin(0.08), 0, 0.01 +
cos(0.08) )
  *SetBodyIC( b_1,                        , , , , 0.1 )
  *SetReal( DS_Gravity.igrav,           1*sin(0.009) )
  *SetBodyIC( b_2,                        1*0.1*cos(0.08), 0.0,
1*0.1*sin(0.08), , 0.0 )
  *SetReal( DS_MotionSolve_Simopts.end_time,       15 )
  *SetPoint( p_0,                       -1.1 - sin(0.08) - sin(0.22),
, 0.01 + cos(0.08) - cos(0.22) )
  *SetEntityNumber( j_2,                      DEFAULT )
  *SetEntityId( j_2,                      DEFAULT )
  *SetEntityNumber( con_0,                      DEFAULT )
  *SetEntityId( con_0,                      DEFAULT )
  *SetSensor( sen_2,                      LIN, 0.0, 0.05, EQ, 0.0,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, NO_RETURN, OFF,
NO_YYDUMP )
  *SetEntityId( sen_2,                      DEFAULT )
  *SetSensorEvaluate( sen_2,                      LIN )
  *SetSensorEvaluate( sen_2,                      EXPR, `` )
  *Set( sen_2.do_evaluate, false )
  *SetEntityNumber( sen_0,                      DEFAULT )
  *SetEntityNumber( sen_1,                      DEFAULT )
  *SetSensor( sen_3,                      USER, `USER()`, 0.0, EQ, 0.0,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, NO_RETURN, OFF,
NO_YYDUMP )
  *SetSensor( sen_3,                      LIN, 0.0, 0.0, EQ, 0.0,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, NO_RETURN, OFF,
NO_YYDUMP )
  *SetSensor( sen_3,                      CRV, , , , 0.0, EQ, 0.0,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, NO_RETURN, OFF,
NO_YYDUMP )
  *SetEntityNumber( sen_3,                      DEFAULT )
  *SetBodyICFlag( b_1,                      true, false, true )
  *SetEntityNumber( m_0,                      DEFAULT )
  *SetEntityNumber( m_1,                      DEFAULT )
  *SetEntityNumber( m_3,                      DEFAULT )

  ////////////////////////////////////////////////////////////////
  *SetSystem( MODEL.DS_MotionSolve_Simopts )  //MotionSolve Simulation
Options
```

```
  *SetBoolean( use_init_pos_mrf,           false )

  ////////////////////////////////////////////////////////////////
  *SetSystem( MODEL )  //The Model

  *SetReal( DS_MotionSolve_Transient_Simopts.h_max,       0.001 )

  ////////////////////////////////////////////////////////////////
  *SetSystem( MODEL.DS_MotionSolve_Transient_Simopts )  //MotionSolve
Transient Options

  *SetBoolean( dae_vel_ctrl,               true )

  ////////////////////////////////////////////////////////////////
  *SetSystem( MODEL )  //The Model

  *SetOption( DS_MotionSolve_Simopts.harwell_lib,       "MA48" )
  *SetReal( DS_MotionSolve_Transient_Simopts.integr_tol,       0.001 )
  *SetOption( DS_MotionSolve_Transient_Simopts.integrator_type,
"MSTIFF" )
  *SetSensor( sen_3,                       EXPR,
`VZ({the_model.b_2.cm.idstring},{the_model.B_Ground.cm.idstring})`,
0.0, LE, 0.0, NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN,
OFF, NO_YYDUMP )
  *SetEntityNumber( m_2,                         24 )
  *SetSensor( sen_1,                       EXPR,
`DZ({b_1.cm.idstring})`, 0.01, LE, 0, NO_CODGEN, OFF, NO_HALT,
NO_PRINT, NO_RESTART, RETURN, OFF, NO_YYDUMP )
  *SetContact( con_1,                       01e8, 0.01, , 0.3, 0.25,
0.001, .01 )
  *SetSensor( sen_0,                       EXPR,
`DZ({b_0.cm.idstring})`, 0.01, LE, 0.00, NO_CODGEN, OFF, NO_HALT,
NO_PRINT, NO_RESTART, RETURN, OFF, NO_YYDUMP )
  *SetSensor( sen_4,                       EXPR, `{the_model.j_3.FZ}`,
0.0, LE, 0.0, NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN,
OFF, NO_YYDUMP )
  *Set( b_3.useim, false )
  *SetBodyIC( b_0,                         0.1*cos(0.08) +
(3/13.5)*cos(0.22), , 0.1*sin(0.08) - (3/13.5)*sin(0.22), , -(3/13.5 -
0.1) )
  *SetBodyICFlag( b_2,                          , false, , false, , false
)
  *SetReal( DS_Gravity.kgrav,           -1*cos(0.009) )
  *SetEntityId( sen_3,                      DEFAULT )
  *SetEntityNumber( sen_4,                          DEFAULT )
  *SetEntityId( sen_4,                      DEFAULT )
  *SetSensor( sen_2,                       EXPR,
`DX({the_model.b_0.cm.idstring},{the_model.b_1.cm.idstring})`, 0.25,
GE, 0.0, NO_CODGEN, OFF, NO_HALT, PRINT, NO_RESTART, RETURN, OFF,
NO_YYDUMP )
  *SetContact( con_0,                       1e8, 0.01, , 0.3, 0.25,
0.001, .01 )
  *SetBoolean( DS_MotionSolve_Simopts.use_run_panel_values,       true
)

*EndMDL()
```

2) walker_simult.log

```
--- solver log opened on 23-JUN-2008 18:49:30 ---

*************************************************************************
*
**
**
**
**
**                            MotionSolve 9.0
**
**
**
**                  Multi-body Dynamics Analysis Software
**
**                     from Altair Engineering, Inc.
**
**
**
**
**
**                    Windows XP - Build: 2600 D4CGN6B1
**
**               Two CPU: Intel(R) Pentium(R) D CPU 2.80GHz
**
**                            CPU speed 2800 MHz
**
**                         266  MB RAM, 2446 MB swap
**
**                        Machine Epsilon : 2.2204E-16
**
**
**
*************************************************************************
*
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** Contains trade secrets of Altair Engineering, Inc.
**
** Decompilation or disassembly of this software strictly prohibited.
**
*************************************************************************
*


WARNING: For Contact/301001 normal_trans_vel cannot be zero.
         It has been reset to 1.

WARNING: For Contact/301002 normal_trans_vel cannot be zero.
         It has been reset to 1.
54 model elements processed.
 Deactivate SENSOR/301001
```

```
 Deactivate SENSOR/301002
 Deactivate SENSOR/301003
 Deactivate SENSOR/301005
 Deactivate CONTACT/301001
 Deactivate CONTACT/301002
 Deactivate JOINT/301005
 Deactivate JOINT/301006

Checking out license ...
License OK.
Time spent in checking out license: 0.203 sec.


WARNING: Inertia of Part/30102 [mass=1.] is auto-corrected.
          The corrected values are:
          Ixx = 0.000394766
          Iyy = 0.000394766
          Izz = 0.000394766

WARNING: Inertia of Part/30103 [mass=1.] is auto-corrected.
          The corrected values are:
          Ixx = 0.000394766
          Iyy = 0.000394766
          Izz = 0.000394766

WARNING: Inertia of Part/30104 [mass=1000.] is auto-corrected.
          The corrected values are:
          Ixx = 39.476663
          Iyy = 39.476663
          Izz = 39.476663

WARNING: Part/30105 is given a nonzero dummy mass/inertia.
          The values are:
          mass = 0.005
          Ixx = 1.1543E-06
          Iyy = 1.1543E-06
          Izz = 1.1543E-06

 The model was found to have non-physically low inertia. They were
corrected
 and assigned the inertia of a solid sphere made of steel with
density=7700 kg/m^3.
 To diasble inertia correction, set Model attibute inertia_correction
to FALSE.


 Set Model attibute zero_mass to control its magnitude.
 Note the zero-mass must be specified in KILOGRAM.


Model unit: length - METER
            time   - SECOND
            force  - NEWTON
            mass   - KILOGRAM
 Sending off  27 markers ...
 Sending off   5 rigid bodies ...
 Sending off   2 spherical joints ...
```

```
 Sending off   1 fixed joints ...
 Sending off   3 revolute joints ...
 Sending off gravity vector ...
 Sending off   5 event sensors ...
 Sending off   1 user-expressions requests ...
 Sending off   3 graphics ...
 Sending off   2 contact force elements ...

 < Kinematic Connectivity >

 Ground     -- Part/30105 DOF=  0 [Fixed Joint]
 Part/30102 -- Part/30104 DOF=  1 [Revolute Joint]
 Part/30103 -- Part/30104 DOF=  1 [Revolute Joint]
 Part/30103 -- Part/30105 DOF=  1 [Revolute Joint]
 Number of Edge(s):  4

 < Directional Connectivity (Parent -> Child) >

 Spanning Tree 1 of 1:
 -------------------------------------------------
 Ground     -> Part/30105 [Fixed Joint]
 Part/30103 -> Part/30104 [Revolute Joint]
 Part/30104 -> Part/30102 [Revolute Joint]
 Part/30105 -> Part/30103 [Revolute Joint]
 Number of Cut Joint(s):  0

< Model Summary >

Total Number of Generalized Coordinates  = 30
      Number of Body Coordinates         = 30
      (including ground body)
      Number of Control/Diff States      = 0

Total Number of Kinematic Constraints    = 27
      Number of Joint/Ground Constraints = 27
      Number of Motion Constraints       = 0

Net Degrees of Freedom of the Mechanism  = 3
Number of Velocity Initial Conditions    = 18



 Initializing model ...
Analysis model processed
Partitioning generalized coordinates ...

Total Number of Independent Coordinates  = 3
 Solving Initial Velocities ...

 Starting dynamic analysis ...

 DYNAMIC SIMULATION PARAMETERS
 ---------------------------------------------
 Start Time                   : 0.000E+00
 End   Time                   : 1.500E+01
 Print Interval               : 1.000E-02
```

```
 Integrator                   : DSTIFF
 Error Tolerance              : 1.000E-04
 Maximum Step Size            : 1.000E-02
 Minimum Step Size            : 1.000E-06
 DAE Index                    : 3
 DAE Constraint Tolerance     : 1.000E-03
 ---------------------------------------------

WARNING: MAX_ORDER for DSTIFF is reduced to 5!
 Time=2.406E-06; Order=1; H=2.406E-06 [Max Phi=5.811E-16]
 Invoking action [RETURN] triggered by sensor [id=301004] ...

DAE SOLVER STATISTICS (DASPK-Index3)
-----------------------------------------------------
 Number of solution steps                 = 113
 Number of residue evaluations            = 154
 Number of jacobian computations          = 14
 Number of delta calculations             = 154
 Number of error test failures            = 0
 Number of nonlinear convergence failures = 0
 Number of nonlinear iterations           = 154
-----------------------------------------------------

 Analysis return activated by sensor. [time=1.019E+00]

CUMULATIVE COMPUTE TIME INFORMATION
-----------------------------------------------------
 Preprocessing Model      : 1.500E-02 sec
 Core Analysis            : 6.300E-02 sec
 Postprocessing/Messaging : 0.000E+00 sec
 Total Elapsed Time       : 7.800E-02 sec

Parallel processing was disabled.

Solver input file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.x
ml]

Results written to animation/plotting file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.m
rf]

Compute info/messages written to log file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.l
og]

ANALYSIS COMPLETED

 Deactivate SENSOR/301004
 Activate SENSOR/301003

Checking out license ...
License OK.
Time spent in checking out license: 0.281 sec.
```

```
< Model Summary >

Total Number of Generalized Coordinates  = 30
      Number of Body Coordinates         = 30
      (including ground body)
      Number of Control/Diff States      = 0

Total Number of Kinematic Constraints    = 27
      Number of Joint/Ground Constraints = 27
      Number of Motion Constraints       = 0

Net Degrees of Freedom of the Mechanism  = 3
Number of Velocity Initial Conditions    = 18



 Initializing model ...
Analysis model processed
Partitioning generalized coordinates ...

Total Number of Independent Coordinates  = 3

 Starting dynamic analysis ...

 DYNAMIC SIMULATION PARAMETERS
 ---------------------------------------------
 Start Time                   : 1.019E+00
 End   Time                   : 1.500E+01
 Print Interval               : 1.000E-02

 Integrator                   : DSTIFF
 Error Tolerance              : 1.000E-04
 Maximum Step Size            : 1.000E-02
 Minimum Step Size            : 1.000E-06
 DAE Index                    : 3
 DAE Constraint Tolerance     : 1.000E-03
 ---------------------------------------------

WARNING: MAX_ORDER for DSTIFF is reduced to 5!
 Invoking action [PRINT] triggered by sensor [id=301003] ...
 Invoking action [RETURN] triggered by sensor [id=301003] ...

DAE SOLVER STATISTICS (DASPK-Index3)
-----------------------------------------------------
 Number of solution steps                 = 58
 Number of residue evaluations            = 95
 Number of jacobian computations          = 13
 Number of delta calculations             = 95
 Number of error test failures            = 0
 Number of nonlinear convergence failures = 0
 Number of nonlinear iterations           = 95
-----------------------------------------------------

 Analysis return activated by sensor. [time=1.448E+00]
```

```
CUMULATIVE COMPUTE TIME INFORMATION
-----------------------------------------------------
 Preprocessing Model      : 1.500E-02 sec
 Core Analysis            : 1.260E-01 sec
 Postprocessing/Messaging : 0.000E+00 sec
 Total Elapsed Time       : 1.410E-01 sec

Parallel processing was disabled.

Solver input file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.x
ml]

Results written to animation/plotting file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.m
rf]

Compute info/messages written to log file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.l
og]

ANALYSIS COMPLETED

 Deactivate SENSOR/301003
 Activate SENSOR/301001

Checking out license ...
License OK.
Time spent in checking out license: 0.188 sec.


< Model Summary >

Total Number of Generalized Coordinates  = 30
      Number of Body Coordinates         = 30
      (including ground body)
      Number of Control/Diff States      = 0

Total Number of Kinematic Constraints    = 27
      Number of Joint/Ground Constraints = 27
      Number of Motion Constraints       = 0

Net Degrees of Freedom of the Mechanism  = 3
Number of Velocity Initial Conditions    = 18



 Initializing model ...
Analysis model processed
Partitioning generalized coordinates ...

Total Number of Independent Coordinates  = 3

 Starting dynamic analysis ...
```

```
 DYNAMIC SIMULATION PARAMETERS
 ---------------------------------------------
 Start Time                    : 1.448E+00
 End   Time                    : 1.500E+01
 Print Interval                : 1.000E-02

 Integrator                    : DSTIFF
 Error Tolerance               : 1.000E-04
 Maximum Step Size             : 1.000E-02
 Minimum Step Size             : 1.000E-06
 DAE Index                     : 3
 DAE Constraint Tolerance      : 1.000E-03
 ---------------------------------------------

WARNING: MAX_ORDER for DSTIFF is reduced to 5!
 Time=2.823E+00; Order=3; H=1.000E-02 [Max Phi=2.881E-09]
 Invoking action [RETURN] triggered by sensor [id=301001] ...

DAE SOLVER STATISTICS (DASPK-Index3)
-----------------------------------------------------
 Number of solution steps                 = 158
 Number of residue evaluations            = 244
 Number of jacobian computations          = 14
 Number of delta calculations             = 244
 Number of error test failures            = 1
 Number of nonlinear convergence failures = 0
 Number of nonlinear iterations           = 244
-----------------------------------------------------

 Analysis return activated by sensor. [time=2.863E+00]

CUMULATIVE COMPUTE TIME INFORMATION
-----------------------------------------------------
 Preprocessing Model      : 3.100E-02 sec
 Core Analysis            : 1.730E-01 sec
 Postprocessing/Messaging : 4.700E-02 sec
 Total Elapsed Time       : 2.510E-01 sec

Parallel processing was disabled.

Solver input file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.x
ml]

Results written to animation/plotting file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.m
rf]

Compute info/messages written to log file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.l
og]

ANALYSIS COMPLETED
```

```
 Deactivate SENSOR/301001
 Activate JOINT/301005
 Deactivate JOINT/301003

Checking out license ...
License OK.
Time spent in checking out license: 0.281 sec.


< Model Summary >

Total Number of Generalized Coordinates  = 30
      Number of Body Coordinates         = 30
      (including ground body)
      Number of Control/Diff States      = 0

Total Number of Kinematic Constraints    = 25
      Number of Joint/Ground Constraints = 25
      Number of Motion Constraints       = 0

Net Degrees of Freedom of the Mechanism  = 5
Number of Velocity Initial Conditions    = 18



 Initializing model ...
Analysis model processed
Partitioning generalized coordinates ...

Total Number of Independent Coordinates  = 5

 Starting dynamic analysis ...

 DYNAMIC SIMULATION PARAMETERS
 ------------------------------------------------
 Start Time                   : 2.863E+00
 End   Time                   : 1.500E+01
 Print Interval               : 1.000E-02

 Integrator                   : DSTIFF
 Error Tolerance              : 1.000E-04
 Maximum Step Size            : 1.000E-02
 Minimum Step Size            : 1.000E-06
 DAE Index                    : 3
 DAE Constraint Tolerance     : 1.000E-03
 ------------------------------------------------

Maximum initial residual=7.612E-01, idx=132, Phi 0

WARNING: MAX_ORDER for DSTIFF is reduced to 5!
ERROR: [DASPK] The nonlinear system solver in the time integration
could not converge
 .....
ERROR: [DASPK] The nonlinear system solver in the time integration
could not converge
 .....
```

```
DAE SOLVER STATISTICS (DASPK-Index3)
-----------------------------------------------------
 Number of solution steps                  = 0
 Number of residue evaluations             = 20
 Number of jacobian computations           = 10
 Number of delta calculations              = 20
 Number of error test failures             = 0
 Number of nonlinear convergence failures = 10
 Number of nonlinear iterations            = 20
-----------------------------------------------------

At time=2.863E+00 the integrator failed to proceed.

----------- Possible Causes ----------------------------------------
----------
(1) The integration has become unstable. Tighten (decrease) integr_tol,
h_max,
or both in Param_Transient can help stabilize the integration. If the
simulation
contains distinctive phases, use multiple Simulate, each with its
own proper integrator parameter setting, to selectively tighten the
tolerance
during the period where instability is encountered. If the simulation
was
terminated because stepsize has diminished consistently below h_min,
reduce
h_min in Param_Transient to force integration to continue.
(2) Numerical singularity in constraint Jacobian matrix. This may
indicate
a mechanism design problem such as a lock up, or a bifurcation
situation.
Try options in linsolver (MA28/MA48). This can sometimes get around
singularity.
(3) Non-physical inertia properties, such as mass=100 Kg and
Ixx=Iyy=Izz=1 Kg*mm^2,
or extremely small inertia on a part with an unconstrained degree of
freedom.
Make sure the modeling data, in particular the part inertia and the
gravity, are
specified in proper units consistent with the units given in Param_Unit
element.
(4) Beam, flexible body goes out of linear range, bushing has large
rotation along
more than one axis, curve goes out of its interpolation range, higher-
pair joint
goes out of the range of U or V, etc. Make sure fundamental modeling
assumptions,
such as rigid contact assumption used in Force_Contact, are not
violated.
(5) Motion displacement defined using LINSPL, AKISPL in dynamic
analysis, or as a
function of model states (DX, VX etc), as well as forces defined as a
function of
other forces, can cause hard convergence and integrator failure. Avoid
these
modeling practices wherever possible.
```

```
------------------------------------------------------------------------
----------


CUMULATIVE COMPUTE TIME INFORMATION
-----------------------------------------------------
 Preprocessing Model      : 4.600E-02 sec
 Core Analysis            : 2.200E-01 sec
 Postprocessing/Messaging : 4.700E-02 sec
 Total Elapsed Time       : 3.130E-01 sec

Parallel processing was disabled.

Solver input file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.x
ml]

Results written to animation/plotting file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.m
rf]

Compute info/messages written to log file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/walker_simult.l
og]

Error encountered in analysis!


Forced termination from API_SendOffCommandSimulate!
--- solver log closed on 23-JUN-2008 18:49:31 ---
```

3) simplest_walker.mdl

```
////////////////////////////////////////////////////////////////////
 Altair HyperWorks

 Version : HWVERSION_9.0b105_Feb  9 2008_22:53:19

 Model : The Model

 Customer ID :

 Date : 06/24/08 19:07:48
////////////////////////////////////////////////////////////////////

*BeginMDL(the_model, "The Model", "9.0b105" )

  *SetCurrentSolverMode(MotionSolve)
  *Point( p_0, "Point 0" )
  *Point( p_1, "Point 1" )
  *Point( p_2, "Point 2" )
```

```
  *Body( b_0, "Body 0", p_0 )
  *Body( b_1, "Body 1", p_1 )
  *Body( b_2, "Body 2", p_2 )
  *Body( b_3, "Body 3", P_Global_Origin )
  *Graphic( gra_0, "Graphic 0", CYLINDER, b_0, p_0, MODEL.p_2, 0.005,
gra_0.r1, , 0.0, CAPBOTH )
  *Graphic( gra_2, "Graphic 3", BOX, b_3, CENTER, P_Global_Origin, ZX,
MODEL.V_Global_Z, MODEL.V_Global_X, 2.8, 1.0, 0.02 )
  *Graphic( gra_1, "Graphic 1", CYLINDER, b_1, p_1, MODEL.p_2, 0.005,
gra_1.r1, , 0.0, CAPBOTH )
  *FixedJoint( j_0, "Joint 3G", MODEL.b_3, MODEL.B_Ground,
MODEL.P_Global_Origin )
  *RevJoint( j_1, "Joint 02", b_0, b_2, p_2, MODEL.V_Global_Y )
  *RevJoint( j_2, "Joint 12", b_1, b_2, p_2, MODEL.V_Global_Y )
  *Sensor( sen_0, "b0_z" )
  *Sensor( sen_1, "b1_z" )
  *Template( tmplt_0, "commandset", SOLVER_COMMAND, def_tmplt_0 )
  *RevJoint( j_3, "Joint 13", MODEL.b_1, MODEL.b_3, MODEL.p_1,
MODEL.V_Global_Y )
  *Contact( con_0, "Contact 0", POISSON, ON, 1, gra_0, false, 1, gra_2,
false )
  *Contact( con_1, "Contact 1", POISSON, ON, 1, gra_1, false, 1, gra_2,
false )
  *Sensor( sen_2, "dx_b0_b1" )
  *Sensor( sen_3, "b2_vz" )
  *Sensor( sen_4, "b1_b3_fz" )
  *Template( model_statement, "model_statement", SOLVER_INPUT,
def_model_statement )
  *Marker( m_0, "Marker 0", b_0, p_0, FLOATING )
  *Marker( m_1, "Marker 1", b_1, p_1, FLOATING )
  *Marker( m_2, "Marker 2", b_3, p_0, FLOATING )
  *Marker( m_3, "Marker 3", b_3, p_1, FLOATING )
  *Sensor( sen_5, "b0_vz" )

  *DefineTemplate( def_tmplt_0 )
 <H3DOutput
     switch_on           = "TRUE"
     increment           = "1"
     start_time          = "0."
     end_time            = "9999999."
     format_option       = "AUTO"
     stress_option       = "TENSOR"
     strain_option       = "TENSOR"
  />

  <Param_Simulation
     constr_tol          = "1.0000E-10"
     implicit_diff_tol   = "1.0000E-06"
  />

  <Param_Transient
     integr_tol          = "0.0001"
     integrator_type     = "DSTIFF"
     h_max               = "0.01"
     h0_max              = "0.001"
  />
```

```
<Deactivate
     element_type  = "SENSOR"
     element_id    = "301001"
/>

<Deactivate
     element_type  = "SENSOR"
     element_id    = "301002"
/>

<Deactivate
     element_type        = "SENSOR"
     element_id          = "301003"
 />

 <Deactivate
     element_type        = "SENSOR"
     element_id          = "301005"
 />

<Deactivate
     element_type        = "SENSOR"
     element_id          = "301006"
 />

 <Deactivate
     element_type = "CONTACT"
     element_id = "301001"
 />

 <Deactivate
     element_type = "CONTACT"
     element_id = "301002"
 />

 <Deactivate
     element_type = "JOINT"
     element_id = "301005"
 />

 <Deactivate
     element_type = "JOINT"
     element_id = "301006"
 />

<Simulate
     analysis_type       = "Transient"
     end_time            = "15."
     print_interval      = "0.01"
/>



 <Deactivate
     element_type        = "SENSOR"
     element_id          = "301004"
```

```
/>

{if (the_model.b_1.vx == 0)}

<Activate
    element_type        = "SENSOR"
    element_id          = "301003"
/>

<Simulate
    analysis_type       = "Transient"
    end_time            = "15."
    print_interval      = "0.01"
/>




<Deactivate
    element_type        = "SENSOR"
    element_id          = "301003"
/>

<Activate
    element_type = "SENSOR"
    element_id = "301006"
/>

<Simulate
    analysis_type       = "Transient"
    end_time            = "15."
    print_interval      = "0.01"
/>



<Deactivate
    element_type = "SENSOR"
    element_id = "301006"
/>

<Activate
    element_type = "JOINT"
    element_id = "301005"
/>

<Deactivate
    element_type = "JOINT"
    element_id = "301003"
/>

<Simulate
    analysis_type       = "Transient"
    end_time            = "15."
    print_interval      = "0.01"
/>
```

```
 {endif}  *EndDefine()

  *DefineTemplate( def_model_statement )
<Constraint_Joint
     id                  = "301005"
     type                = "SPHERICAL"
     i_marker_id         = "30102021"
     j_marker_id         = "30105020"
/>

<Constraint_Joint
     id                  = "301006"
     type                = "SPHERICAL"
     i_marker_id         = "30103032"
     j_marker_id         = "30105031"
/>  *EndDefine()

  ////////////////////////////////////////////////////////////////
  *SetSystem( MODEL )  //The Model

  *SetOption( DS_Units.op_length,         "METER" )
  *Set( b_0.usecm, true )
  *SetBodyInertia( b_0,                        1.0 )
  *SetBodyICFlag( b_0,                        false )
  *Set( b_1.usecm, true )
  *SetBodyInertia( b_2,                        1000.0 )
  *Set( b_2.usecm, true )
  *Set( b_3.usecm, true )
  *SetBodyInertia( b_1,                        1 )
  *Set( gra_2.is_material_inside, true )
  *SetSensor( sen_0,                       USER, `USER()`, 0.0, EQ, 0.0,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, NO_RETURN, OFF,
NO_YYDUMP )
  *SetSensor( sen_0,                       LIN, , 0.0, EQ, 0.0,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, NO_RETURN, OFF,
NO_YYDUMP )
  *SetNote( sen_0,                      )
  *SetSensor( sen_1,                       LIN, , 0.02, LE, -1e-8,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN, OFF, NO_YYDUMP )
  *SetEntityId( sen_0,                       301001 )
  *SetEntityNumber( sen_1,                       1 )
  *SetEntityId( sen_1,                       301002 )
  *SetBodyIC( b_3,                         , , , , 0.0 )
  *SetReal( DS_MotionSolve_Simopts.end_time,       15 )
  *SetPoint( p_1,                         -1.1, , 0.01 )
  *SetPoint( p_0,                         -1.1 - sin(0.08) - sin(0.22),
, 0.01 + cos(0.08) - cos(0.22) )
  *SetPoint( p_2,                         -1.1 - sin(0.08), 0, 0.01 +
cos(0.08) )
  *SetBodyIC( b_1,                         , , , , 0.1 )
  *SetBodyICFlag( b_2,                         , false, , false, , false
)
  *SetBodyIC( b_2,                         1*0.1*cos(0.08), 0.0,
1*0.1*sin(0.08), , 0.0 )
  *SetReal( DS_Gravity.kgrav,           -1*cos(0.009) )
  *SetReal( DS_Gravity.igrav,           1*sin(0.009) )
  *SetSensor( sen_4,                       LIN, 0.0, 0.0, EQ, 0.0,
```

```
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN, OFF, NO_YYDUMP )
  *SetSensor( sen_4,                      EXPR, `{the_model.j_3.FZ}`,
0.0, EQ, 0.0, NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN,
OFF, NO_YYDUMP )
  *SetEntityId( sen_4,                      301005 )
  *SetEntityId( sen_2,                      301003 )
  *SetEntityId( sen_3,                      301004 )
  *SetEntityId( j_0,                        301004 )
  *SetEntityId( j_1,                        301001 )
  *SetEntityId( j_2,                        301002 )
  *SetEntityId( j_3,                        301003 )
  *SetEntityId( model_statement,            DEFAULT )
  *SetEntityId( m_0,                        DEFAULT )
  *SetEntityId( m_1,                        DEFAULT )
  *SetEntityId( m_2,                        DEFAULT )
  *SetEntityId( m_3,                        DEFAULT )
  *SetBodyIC( b_0,                       0.1*cos(0.08) +
(3/13.5)*cos(0.22), , 0.1*sin(0.08) - (3/13.5)*sin(0.22), , -3/13.5 )
  *SetContact( con_1,                     1e8, , , 0.25, 0.30, 0.001,
1e-3 )
  *SetContact( con_0,                     1e8, 0.01, , 0.25, 0.30, 1e-
3, 1e-3 )
  *SetSensor( sen_5,                      LIN, , 0.01, GE, 0.0,
NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN, OFF, NO_YYDUMP )
  *SetEntityId( sen_5,                      301006 )
  *SetSensor( sen_1,                      EXPR,
``DZ({b_1.cm.idstring})``, 0.01, LE, 0, NO_CODGEN, OFF, NO_HALT,
NO_PRINT, NO_RESTART, RETURN, OFF, NO_YYDUMP )
  *SetEntityNumber( sen_0,                          DEFAULT )
  *SetSensor( sen_0,                      EXPR,
`DZ({b_0.cm.idstring})`, 0.01, LE, -5e-3, NO_CODGEN, OFF, NO_HALT,
NO_PRINT, NO_RESTART, RETURN, OFF, NO_YYDUMP )
  *SetSensor( sen_3,                      EXPR,
`VZ({the_model.b_2.cm.idstring},{the_model.B_Ground.cm.idstring})`,
0.0, LE, 0.0, NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN,
OFF, NO_YYDUMP )
  *SetSensor( sen_2,                      EXPR,
`DX({the_model.b_0.cm.idstring},{the_model.b_1.cm.idstring})`, 0.45,
GE, 0.0, NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN, OFF,
NO_YYDUMP )
  *SetSensor( sen_5,                      EXPR,
`VZ({the_model.b_0.cm.idstring},{the_model.B_Ground.cm.idstring})`, 0,
GE, 0.0, NO_CODGEN, OFF, NO_HALT, NO_PRINT, NO_RESTART, RETURN, OFF,
NO_YYDUMP )
  *SetBoolean( DS_MotionSolve_Simopts.use_run_panel_values,       true
)

*EndMDL()
```

4) simplest_walker.log

```
-- solver log opened on 24-JUN-2008 19:07:52 ---

*************************************************************************
*
**
**
**
**
**                            MotionSolve 9.0
**
**
**
**                  Multi-body Dynamics Analysis Software
**
**                     from Altair Engineering, Inc.
**
**
**
**
**
**                    Windows XP - Build: 2600 D4CGN6B1
**
**               Two CPU: Intel(R) Pentium(R) D CPU 2.80GHz
**
**                            CPU speed 2800 MHz
**
**                         232  MB RAM, 2446 MB swap
**
**                       Machine Epsilon : 2.2204E-16
**
**
**
*************************************************************************
*
**  COPYRIGHT (C) 2004-2008                 Altair Engineering, Inc.
**
** All Rights Reserved.  Copyright notice does not imply publication.
**
** Contains trade secrets of Altair Engineering, Inc.
**
** Decompilation or disassembly of this software strictly prohibited.
**
*************************************************************************
*


WARNING: For Contact/301001 normal_trans_vel cannot be zero.
         It has been reset to 1.

WARNING: For Contact/301002 normal_trans_vel cannot be zero.
         It has been reset to 1.
52 model elements processed.
 Deactivate SENSOR/301001
```

```
 Deactivate SENSOR/301002
 Deactivate SENSOR/301003
 Deactivate SENSOR/301005
 Deactivate SENSOR/301006
 Deactivate CONTACT/301001
 Deactivate CONTACT/301002
 Deactivate JOINT/301005
 Deactivate JOINT/301006

Checking out license ...
License OK.
Time spent in checking out license: 0.234 sec.


WARNING: Inertia of Part/30102 [mass=1.] is auto-corrected.
          The corrected values are:
          Ixx = 0.000394766
          Iyy = 0.000394766
          Izz = 0.000394766

WARNING: Inertia of Part/30103 [mass=1.] is auto-corrected.
          The corrected values are:
          Ixx = 0.000394766
          Iyy = 0.000394766
          Izz = 0.000394766

WARNING: Inertia of Part/30104 [mass=1000.] is auto-corrected.
          The corrected values are:
          Ixx = 39.476663
          Iyy = 39.476663
          Izz = 39.476663

WARNING: Part/30105 is given a nonzero dummy mass/inertia.
          The values are:
          mass = 0.005
          Ixx = 1.1543E-06
          Iyy = 1.1543E-06
          Izz = 1.1543E-06

 The model was found to have non-physically low inertia. They were
corrected
 and assigned the inertia of a solid sphere made of steel with
density=7700 kg/m^3.
 To diasble inertia correction, set Model attibute inertia_correction
to FALSE.


 Set Model attibute zero_mass to control its magnitude.
 Note the zero-mass must be specified in KILOGRAM.


Model unit: length - METER
            time   - SECOND
            force  - NEWTON
            mass   - KILOGRAM
 Sending off  25 markers ...
 Sending off   5 rigid bodies ...
```

```
 Sending off   2 spherical joints ...
 Sending off   1 fixed joints ...
 Sending off   3 revolute joints ...
 Sending off gravity vector ...
 Sending off   6 event sensors ...
 Sending off   3 graphics ...
 Sending off   2 contact force elements ...

 < Kinematic Connectivity >

 Ground     -- Part/30105 DOF=  0 [Fixed Joint]
 Part/30102 -- Part/30104 DOF=  1 [Revolute Joint]
 Part/30103 -- Part/30104 DOF=  1 [Revolute Joint]
 Part/30103 -- Part/30105 DOF=  1 [Revolute Joint]
 Number of Edge(s):  4

 < Directional Connectivity (Parent -> Child) >

 Spanning Tree 1 of 1:
 -------------------------------------------------
 Ground     -> Part/30105 [Fixed Joint]
 Part/30103 -> Part/30104 [Revolute Joint]
 Part/30104 -> Part/30102 [Revolute Joint]
 Part/30105 -> Part/30103 [Revolute Joint]
 Number of Cut Joint(s):  0

< Model Summary >

Total Number of Generalized Coordinates  = 30
      Number of Body Coordinates         = 30
      (including ground body)
      Number of Control/Diff States      = 0

Total Number of Kinematic Constraints    = 27
      Number of Joint/Ground Constraints = 27
      Number of Motion Constraints       = 0

Net Degrees of Freedom of the Mechanism  = 3
Number of Velocity Initial Conditions    = 17



 Initializing model ...
Analysis model processed
Partitioning generalized coordinates ...

Total Number of Independent Coordinates  = 3
 Solving Initial Velocities ...

 Starting dynamic analysis ...

 DYNAMIC SIMULATION PARAMETERS
 ---------------------------------------------
 Start Time                   : 0.000E+00
 End   Time                   : 1.500E+01
 Print Interval               : 1.000E-02
```

```
 Integrator                   : DSTIFF
 Error Tolerance              : 1.000E-04
 Maximum Step Size            : 1.000E-02
 Minimum Step Size            : 1.000E-06
 DAE Index                    : 3
 DAE Constraint Tolerance     : 1.000E-03
 -----------------------------------------------

 Time=2.406E-06; Order=1; H=2.406E-06 [Max Phi=5.811E-16]
 Invoking action [RETURN] triggered by sensor [id=301004] ...

DAE SOLVER STATISTICS (DASPK-Index3)
-----------------------------------------------------
 Number of solution steps                = 113
 Number of residue evaluations           = 154
 Number of jacobian computations         = 14
 Number of delta calculations            = 154
 Number of error test failures           = 0
 Number of nonlinear convergence failures = 0
 Number of nonlinear iterations          = 154
-----------------------------------------------------

 Analysis return activated by sensor. [time=1.019E+00]

CUMULATIVE COMPUTE TIME INFORMATION
-----------------------------------------------------
 Preprocessing Model      : 1.600E-02 sec
 Core Analysis            : 4.700E-02 sec
 Postprocessing/Messaging : 3.100E-02 sec
 Total Elapsed Time       : 9.400E-02 sec

Parallel processing was disabled.

Solver input file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.xml]

Results written to animation/plotting file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.mrf]

Compute info/messages written to log file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.log]

ANALYSIS COMPLETED

 Deactivate SENSOR/301004
 Activate SENSOR/301003

Checking out license ...
License OK.
Time spent in checking out license: 0.312 sec.
```

```
< Model Summary >

Total Number of Generalized Coordinates  = 30
      Number of Body Coordinates         = 30
      (including ground body)
      Number of Control/Diff States      = 0

Total Number of Kinematic Constraints    = 27
      Number of Joint/Ground Constraints = 27
      Number of Motion Constraints       = 0

Net Degrees of Freedom of the Mechanism  = 3
Number of Velocity Initial Conditions    = 17



 Initializing model ...
Analysis model processed
Partitioning generalized coordinates ...

Total Number of Independent Coordinates  = 3

 Starting dynamic analysis ...

 DYNAMIC SIMULATION PARAMETERS
 ---------------------------------------------
 Start Time                   : 1.019E+00
 End   Time                   : 1.500E+01
 Print Interval               : 1.000E-02

 Integrator                   : DSTIFF
 Error Tolerance              : 1.000E-04
 Maximum Step Size            : 1.000E-02
 Minimum Step Size            : 1.000E-06
 DAE Index                    : 3
 DAE Constraint Tolerance     : 1.000E-03
 ---------------------------------------------

 Invoking action [RETURN] triggered by sensor [id=301003] ...

DAE SOLVER STATISTICS (DASPK-Index3)
-----------------------------------------------------
 Number of solution steps                 = 151
 Number of residue evaluations            = 322
 Number of jacobian computations          = 13
 Number of delta calculations             = 322
 Number of error test failures            = 0
 Number of nonlinear convergence failures = 0
 Number of nonlinear iterations           = 322
-----------------------------------------------------

 Analysis return activated by sensor. [time=2.378E+00]

CUMULATIVE COMPUTE TIME INFORMATION
-----------------------------------------------------
 Preprocessing Model      : 3.200E-02 sec
```

```
 Core Analysis            : 1.250E-01 sec
 Postprocessing/Messaging : 3.100E-02 sec
 Total Elapsed Time       : 1.880E-01 sec

Parallel processing was disabled.

Solver input file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.xml]

Results written to animation/plotting file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.mrf]

Compute info/messages written to log file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.log]

ANALYSIS COMPLETED

 Deactivate SENSOR/301003
 Activate SENSOR/301006

Checking out license ...
License OK.
Time spent in checking out license: 0.328 sec.


< Model Summary >

Total Number of Generalized Coordinates  = 30
      Number of Body Coordinates         = 30
      (including ground body)
      Number of Control/Diff States      = 0

Total Number of Kinematic Constraints    = 27
      Number of Joint/Ground Constraints = 27
      Number of Motion Constraints       = 0

Net Degrees of Freedom of the Mechanism  = 3
Number of Velocity Initial Conditions    = 17



 Initializing model ...
Analysis model processed
Partitioning generalized coordinates ...

Total Number of Independent Coordinates  = 3

 Starting dynamic analysis ...

 DYNAMIC SIMULATION PARAMETERS
 ---------------------------------------------
```

```
 Start Time                   : 2.378E+00
 End   Time                   : 1.500E+01
 Print Interval               : 1.000E-02

 Integrator                   : DSTIFF
 Error Tolerance              : 1.000E-04
 Maximum Step Size            : 1.000E-02
 Minimum Step Size            : 1.000E-06
 DAE Index                    : 3
 DAE Constraint Tolerance     : 1.000E-03
 ------------------------------------------------

 Invoking action [RETURN] triggered by sensor [id=301006] ...

DAE SOLVER STATISTICS (DASPK-Index3)
-----------------------------------------------------
 Number of solution steps                 = 1
 Number of residue evaluations            = 2
 Number of jacobian computations          = 1
 Number of delta calculations             = 2
 Number of error test failures            = 0
 Number of nonlinear convergence failures = 0
 Number of nonlinear iterations           = 2
-----------------------------------------------------

 Analysis return activated by sensor. [time=2.378E+00]

CUMULATIVE COMPUTE TIME INFORMATION
-----------------------------------------------------
 Preprocessing Model      : 4.800E-02 sec
 Core Analysis            : 1.720E-01 sec
 Postprocessing/Messaging : 3.100E-02 sec
 Total Elapsed Time       : 2.510E-01 sec

Parallel processing was disabled.

Solver input file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.xml]

Results written to animation/plotting file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.mrf]

Compute info/messages written to log file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.log]

ANALYSIS COMPLETED

 Deactivate SENSOR/301006
 Activate JOINT/301005
 Deactivate JOINT/301003
```

```
Checking out license ...
License OK.
Time spent in checking out license: 0.312 sec.


< Model Summary >

Total Number of Generalized Coordinates  = 30
      Number of Body Coordinates         = 30
      (including ground body)
      Number of Control/Diff States      = 0

Total Number of Kinematic Constraints    = 25
      Number of Joint/Ground Constraints = 25
      Number of Motion Constraints       = 0

Net Degrees of Freedom of the Mechanism  = 5
Number of Velocity Initial Conditions    = 17



 Initializing model ...
Analysis model processed
Partitioning generalized coordinates ...

Total Number of Independent Coordinates  = 5

 Starting dynamic analysis ...

 DYNAMIC SIMULATION PARAMETERS
 ------------------------------------------------
 Start Time                   : 2.378E+00
 End   Time                   : 1.500E+01
 Print Interval               : 1.000E-02

 Integrator                   : DSTIFF
 Error Tolerance              : 1.000E-04
 Maximum Step Size            : 1.000E-02
 Minimum Step Size            : 1.000E-06
 DAE Index                    : 3
 DAE Constraint Tolerance     : 1.000E-03
 ------------------------------------------------

Maximum initial residual=7.476E-01, idx=132, Phi 0

ERROR: [DASPK] The nonlinear system solver in the time integration
could not converge
 .....
ERROR: [DASPK] The nonlinear system solver in the time integration
could not converge
 .....

DAE SOLVER STATISTICS (DASPK-Index3)
-----------------------------------------------------
 Number of solution steps                 = 0
 Number of residue evaluations            = 20
 Number of jacobian computations          = 10
```

```
 Number of delta calculations             = 20
 Number of error test failures            = 0
 Number of nonlinear convergence failures = 10
 Number of nonlinear iterations           = 20
-----------------------------------------------------

At time=2.378E+00 the integrator failed to proceed.

----------- Possible Causes ---------------------------------------
----------
(1) The integration has become unstable. Tighten (decrease) integr_tol,
h_max,
or both in Param_Transient can help stabilize the integration. If the
simulation
contains distinctive phases, use multiple Simulate, each with its
own proper integrator parameter setting, to selectively tighten the
tolerance
during the period where instability is encountered. If the simulation
was
terminated because stepsize has diminished consistently below h_min,
reduce
h_min in Param_Transient to force integration to continue.
(2) Numerical singularity in constraint Jacobian matrix. This may
indicate
a mechanism design problem such as a lock up, or a bifurcation
situation.
Try options in linsolver (MA28/MA48). This can sometimes get around
singularity.
(3) Non-physical inertia properties, such as mass=100 Kg and
Ixx=Iyy=Izz=1 Kg*mm^2,
or extremely small inertia on a part with an unconstrained degree of
freedom.
Make sure the modeling data, in particular the part inertia and the
gravity, are
specified in proper units consistent with the units given in Param_Unit
element.
(4) Beam, flexible body goes out of linear range, bushing has large
rotation along
more than one axis, curve goes out of its interpolation range, higher-
pair joint
goes out of the range of U or V, etc. Make sure fundamental modeling
assumptions,
such as rigid contact assumption used in Force_Contact, are not
violated.
(5) Motion displacement defined using LINSPL, AKISPL in dynamic
analysis, or as a
function of model states (DX, VX etc), as well as forces defined as a
function of
other forces, can cause hard convergence and integrator failure. Avoid
these
modeling practices wherever possible.
-----------------------------------------------------------------------
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CUMULATIVE COMPUTE TIME INFORMATION
-----------------------------------------------------
```

```
 Preprocessing Model      : 6.400E-02 sec
 Core Analysis            : 2.340E-01 sec
 Postprocessing/Messaging : 3.100E-02 sec
 Total Elapsed Time       : 3.290E-01 sec

Parallel processing was disabled.

Solver input file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.xml]

Results written to animation/plotting file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.mrf]

Compute info/messages written to log file:
 [C:/Documents and
Settings/Robots/Desktop/rohit_hyperworks/MotionViewWork/simplest_walker
.log]

Error encountered in analysis!


Forced termination from API_SendOffCommandSimulate!
--- solver log closed on 24-JUN-2008 19:07:54 ---
```