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<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE simulation [
<!ENTITY Xmax    "4">
<!ENTITY Vmax    "8">
<!ENTITY NptsBin "200">
]><simulation xmds-version="2">
  <name>brownian_motion_course_MT</name>

  <author> Sebastian Wuester </author>
  <description>
    Brownian motion via Langevin equation
  </description>

  <geometry>
    <propagation_dimension> t </propagation_dimension>
    <transverse_dimensions>
      <dimension name="xbin" lattice="&NptsBin;" domain="(-&Xmax;,&Xmax;)" />
      <dimension name="vbin" lattice="&NptsBin;" domain="(-&Vmax;,&Vmax;)" />
    </transverse_dimensions>
  </geometry>

  <driver name="multi-path" paths="10000" />

  <features>
    <auto_vectorise />
    <fftw />
    <benchmark />
    <globals>
      <![CDATA[
const double mass = 1.0;
const double damping = 1.0;
const double Temperature = 1.0;

const double noiseamp = sqrt(2.0*damping*Temperature);
const double dxbin_halves = (_max_xbin - _min_xbin)/(_lattice_xbin)/2.0;
const double dvbin_halves = (_max_vbin - _min_vbin)/(_lattice_vbin)/2.0;
]]>
    </globals>
  </features>

  <noise_vector name="drivingNoise" kind="Wiener" type="real" method="dsfmt" seed="23 42 1"
    <components>dW</components>
  </noise_vector>

  <vector name="variables" type="real" dimensions="">
    <components> pos  vel </components>
    <initialisation>
      <![CDATA[
pos = 0.0;
vel = 0.0;
]]>
    </initialisation>
  </vector>

  <sequence>
    <integrate algorithm="SI" interval="3" steps="10000">
      <samples>200 200 200</samples>
      <operators>
        <integration_vectors>variables </integration_vectors>
        <dependencies>drivingNoise</dependencies>
        <![CDATA[

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        dpos_dt = vel;
        dvel_dt = -damping/mass*vel + noiseamp/mass*dW;
    ]]>
</operators>
</integrate>
</sequence>

<output format="hdf5">
  <group>
    <sampling basis="" initial_sample="yes">
      <moments>position velocity</moments>
      <dependencies>variables</dependencies>
      <![CDATA[
        position = pos;
        velocity = vel;
      ]]>
    </sampling>
  </group>
  <group>
    <sampling basis="xbin" initial_sample="yes">
      <moments> pos_distribution </moments>
      <dependencies>variables</dependencies>
      <![CDATA[
        if(_index_xbin==0 && pos < (xbin+dxbin_halves))
          pos_distribution +=1.0;
        if( pos > (xbin-dxbin_halves) && pos < (xbin+dxbin_halves) )
          pos_distribution +=1.0;
        if(_index_xbin==_lattice_xbin-1 && pos > (xbin-dxbin_halves) )
          pos_distribution +=1.0;
      ]]>
    </sampling>
  </group>
  <group>
    <sampling basis="vbin" initial_sample="yes">
      <moments> vel_distribution </moments>
      <dependencies>variables</dependencies>
      <![CDATA[
        if(_index_vbin==0 && vel < (vbin+dvbin_halves))
          vel_distribution +=1.0;
        if( vel > (vbin-dvbin_halves) && vel < (vbin+dvbin_halves) )
          vel_distribution +=1.0;
        if(_index_vbin==_lattice_vbin-1 && vel > (vbin-dvbin_halves) )
          vel_distribution +=1.0;
      ]]>
    </sampling>
  </group>
</output>
</simulation>
```