```
Warning: Failure at t=2.913903e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=2.530848e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=2.770952e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=2.585138e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=2.776432e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=3.086544e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=2.927295e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=3.432112e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=2.558348e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=3.640220e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=4.668218e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
Warning: Failure at t=2.795894e-01.  Unable to meet integration tolerances
without reducing the step size below the smallest value allowed (8.881784e-16)
at time t.
```
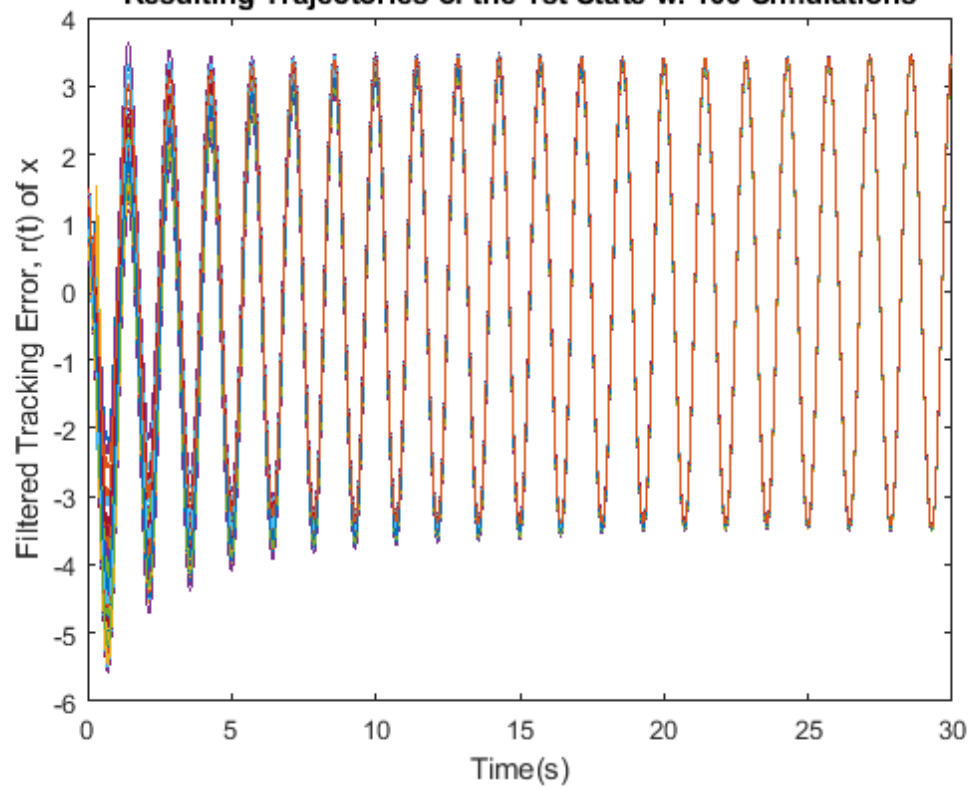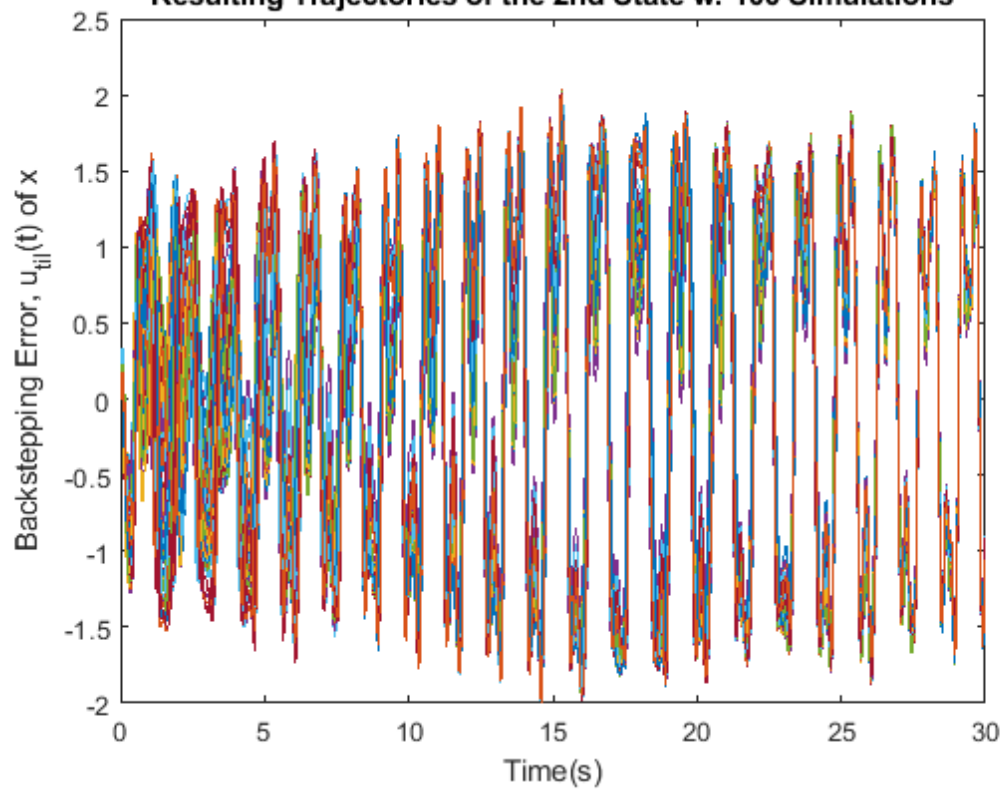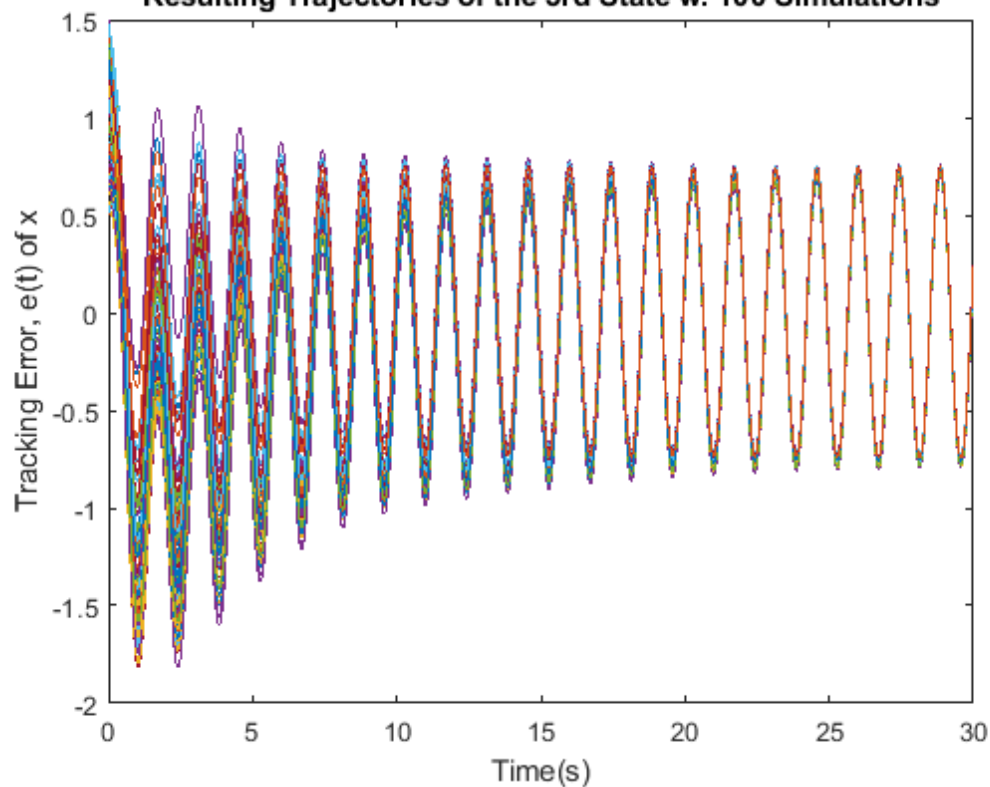
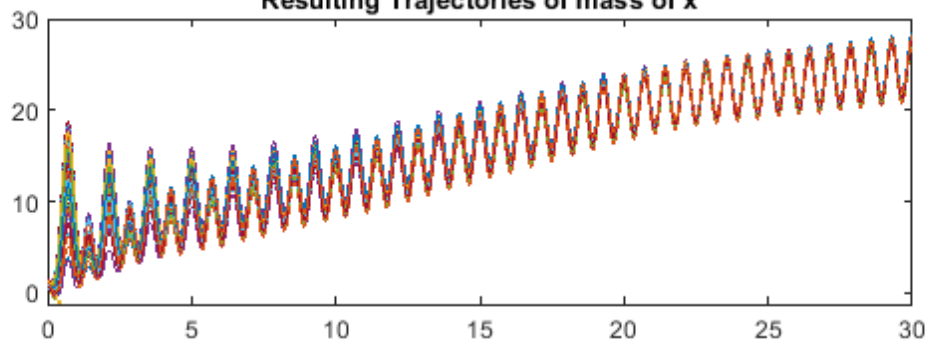**Resulting Trajectories of the 1st State w. 100 Simulations**

Filtered Tracking Error, r(t) of x

Time(s)

Resulting Trajectories of the 2nd State w. 100 Simulations

Backstepping Error, $u_{til}(t)$ of x

Time(s)

Resulting Trajectories of the 3rd State w. 100 Simulations

Tracking Error, e(t) of x

Time(s)

Resulting Trajectories of mass of x

Resulting Trajectories of mass of x

Parametric errors of the collar

Time(s)

Resulting Trajectories of the 5th State w. 100 Simulations

Parametric Input Coefficient Error, $a_{til}(t)$ of x

Time(s)

Resulting Trajectories of the 1st State w. 100 Simulations

Filtered Tracking Error, $r(t)$ of phi

Time(s)

Resulting Trajectories of the 2nd State w. 100 Simulations
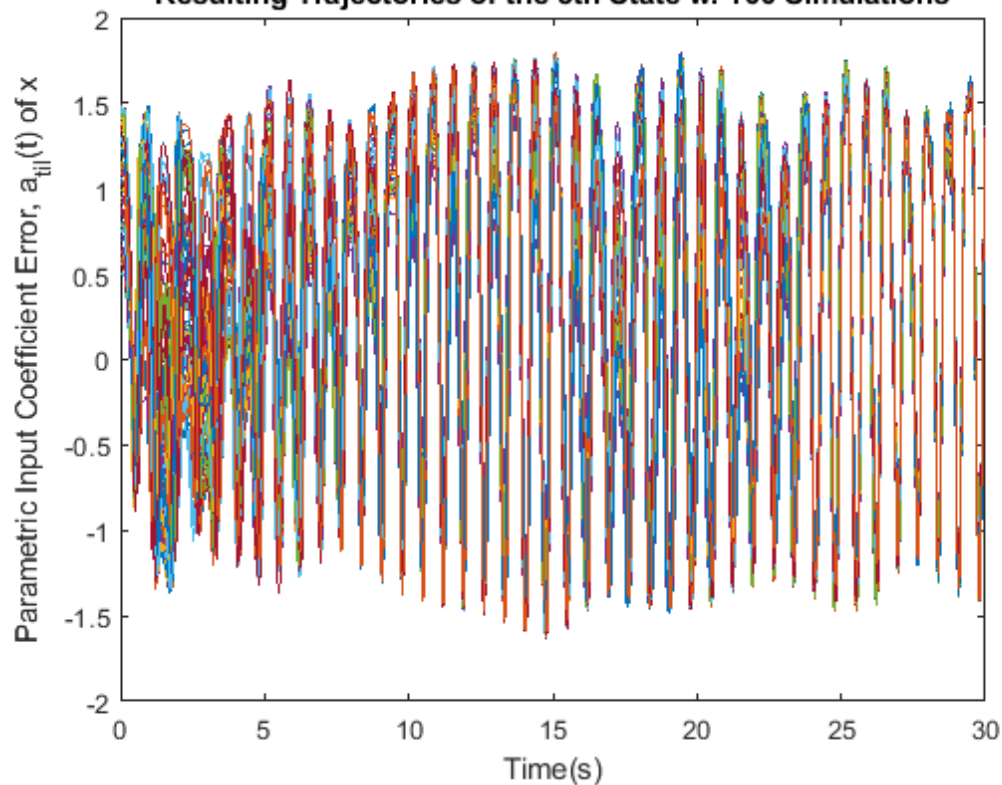
Resulting Trajectories of the 3rd State w. 100 Simulations
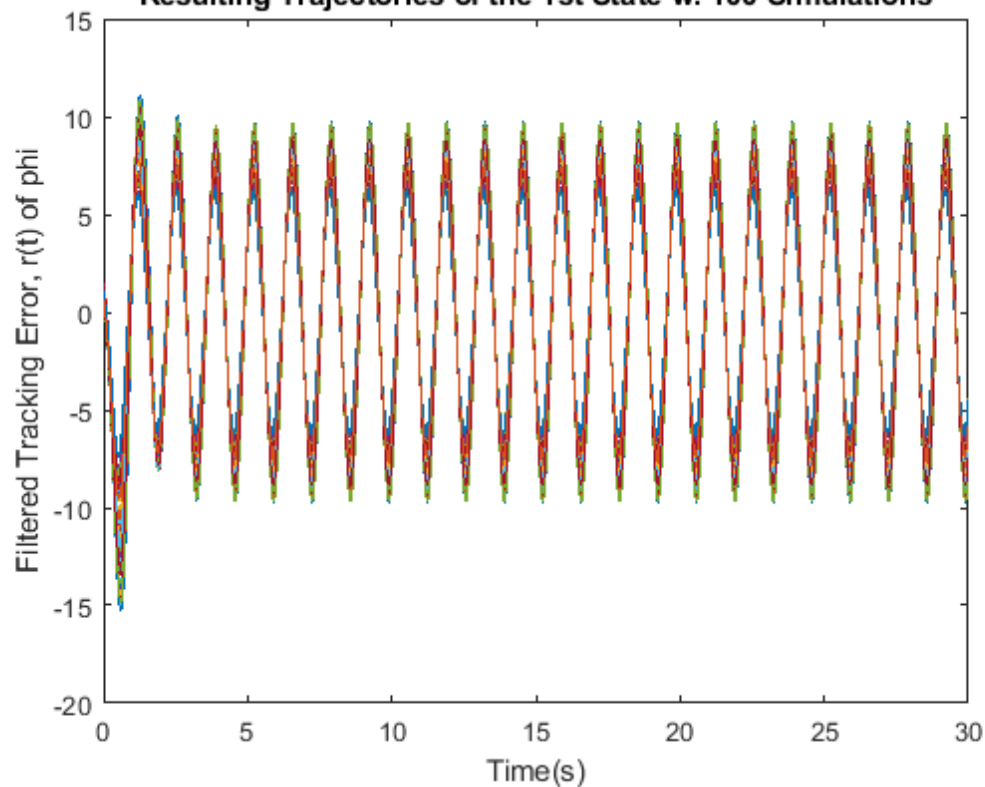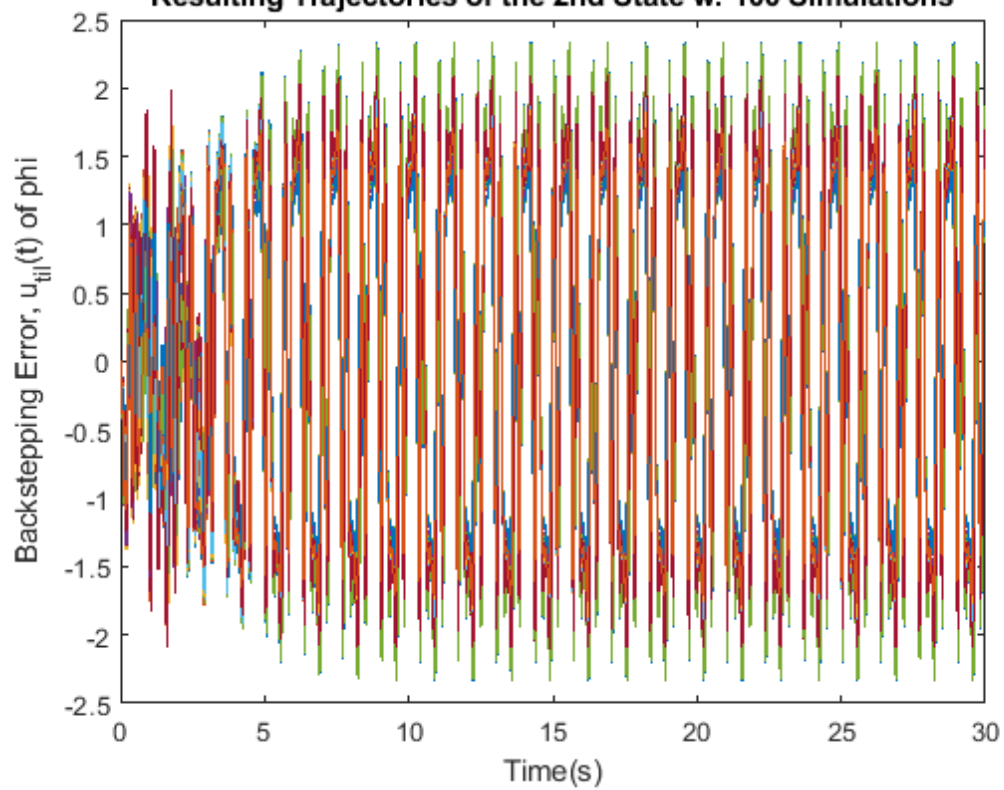
Resulting Trajectories of mass for phi

Resulting Trajectories of mass for phi

Resulting Trajectories of the 5th State w. 100 Simulations