Introduction

- Cyber physical systems (CPSs) integrate computing, signal processing, data analysis, control and communication with physical processes.
- State estimation is an essential component of robust and safe CPSs.

Power Systems — The Most Complex CPS

- In power networks, the estimation problem is an important application of energy management systems.
- Static state estimation (SSE) methods cannot effectively capture the dynamics of power systems due to its dependency on slow update rates of SCADA systems.
- Dynamic state estimator (DSE) enabled by Phasor Measurement Units (PMU) can provide accurate dynamic state estimates of the system.

- Nonlinear Dynamic State Estimator (CKF)
- Connection between sensors, actuators, and the estimators in the power system network, Smart grids are accomplished via a digital communication network.
- Reduction of Communication Event Triggered Mechanism

Event Triggered Mechanism

Sensor outputs are sent to the event detector which determines whether or not information is to be sent through the communication channel to the remote Cubature Kalman filter.

System Model

Simulation Results

<table>
<thead>
<tr>
<th>Initial value of CKF</th>
<th>Number of data transfer</th>
<th>Convergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold Value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>120000</td>
<td>Yes</td>
</tr>
<tr>
<td>0.05</td>
<td>700</td>
<td>yes</td>
</tr>
<tr>
<td>0.1</td>
<td>500</td>
<td>yes</td>
</tr>
<tr>
<td>&gt;0.1</td>
<td>-</td>
<td>No</td>
</tr>
</tbody>
</table>

Conclusion

- Discrete time event triggered Cubature Kalman Filter (DECKF) is proposed.
- Proper event triggered mechanism threshold is chosen
  - Number of data transmission is reduced
  - The error of the state estimation is kept bounded.