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Distributed real-time state estimation of integrated power and gas system

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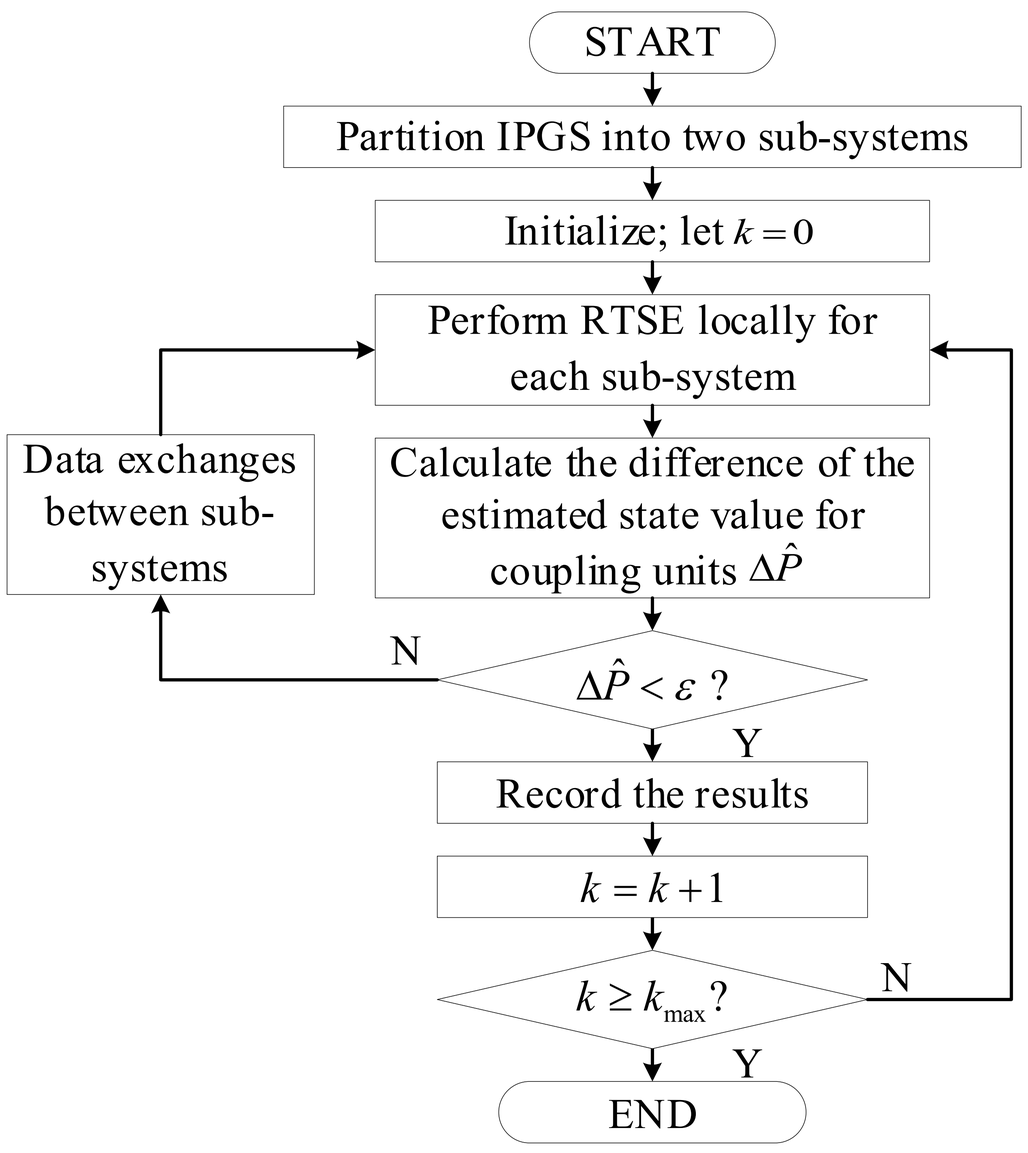
Introduction

Real-time state estimation (RTSE) is crucial for monitoring the integrated power and gas system (IPGS) . To efficiently estimate the accurate states of IPGS, this work proposes a distributed RTSE (D-RTSE) method based on cubature Kalman filter (CKF) considering the slow dynamics of gas system.

D-RTSE scheme for IPGS

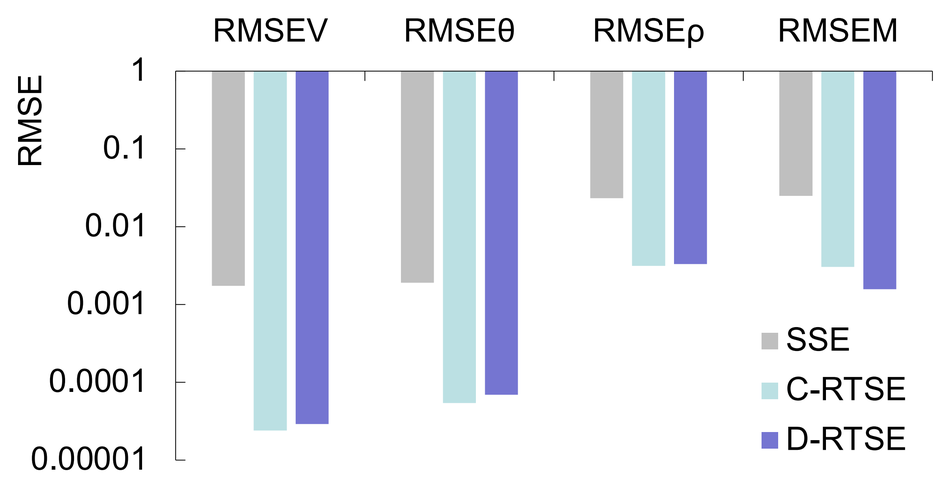
We designed a D-RTSE scheme for the IPGS to address the privacy issues and enhance the computational efficiency.



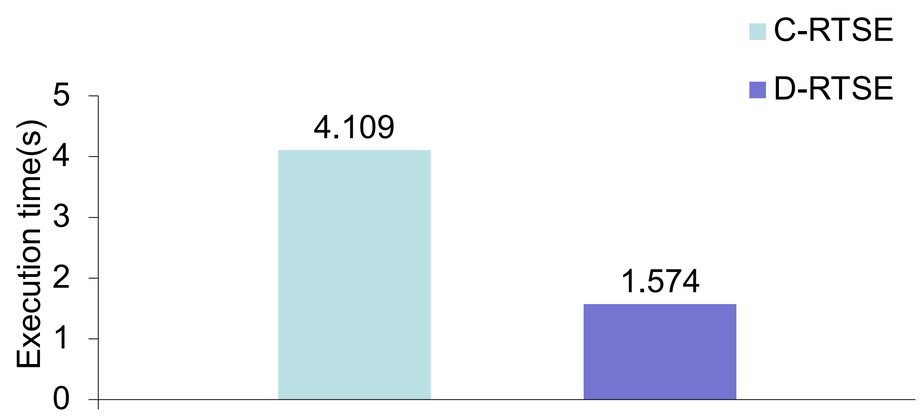
Only **few measurement information is exchanged** between the two systems, which protects the privacy. And the **reduction of system scale** improves the computational efficiency.

Result

The estimation accuracy and computing efficiency are shown, compared with those of static state estimation (SSE) and centralized real-time state estimation （C-RTSE）.



Compared with SSE, the proposed D-RTSE method for IPGS gains higher estimation accuracy, which is close to C-RTSE.



The proposed D-RTSE method achieves much higher computation efficiency, i.e., 61.69% less computing time than C-RTSE.

Conclusion

We propose a D-RTSE method for IPGS based on CKF. The proposed method considers the slow dynamic characteristics of gas system and has superior characteristics in **estimation accuracy, computing efficiency and privacy protection.** In future works, the proposed D-RTSE method will be tested on large-scale IPGS to study its scalability.