Curriculum Vitae

Qian Huang *Research Assistant (Postdoc)*

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Education

- BSc, Dept. of Thermal Engineering, Tsinghua University, China 2008-2012
- PhD, Dept. of Energy and Power Engineering, Tsinghua University, China 2012-2017

Research Experience

Postdoc, Head of Group: Prof. Dr. Christian Rohde 2024-now
Institute of Applied Analysis and Numerical Simulation, University of Stuttgart, Germany

Research Assistant Professor 2019-2024
Department of Energy and Power Engineering, Tsinghua University, China

Postdoc Research, Supervisor: Prof. Wen-An Yong 2017-2019
Zhou Pei-Yuan Center for Applied Mathematics, Tsinghua University, China
Project: *Moment closure of population balance equation and its applications*

PhD Research, Supervisors: Prof. Qiang Yao and Prof. Shuiqing Li 2012-2017
Thesis: *Mechanisms on the particulate formation and ash deposition in pulverized coal combustion*

Research Interests

- Kinetic model theory and applications
- Combustion-related energy conversion & propulsion
- Active particle systems

Research Funding

- **National Science Foundation for Young Scientists of China**, PI. 2020-2022
- **China Postdoctoral Science Foundation**, PI. 2017-2019

Honors & Awards

- Gold medal of the International Exhibition of Inventions Geneva, 2023 (with Prof. Shuiqing Li and others)
- The first prize of Natural Science Award of Ministry of Education of China, 2022 (with Prof. Shuiqing Li and others)
- Best Paper Award of China National Symposium on Combustion, 2021 (with Prof. Shuiqing Li and others)

- Equipment Management & Technical Innovation in Power Industry, First prize, 2021 (with Prof. Shuiqing Li and others)
- Tsinghua-IHI Scholarship, Tsinghua University, 2016
- China Scholarship Council Scholarship, Ministry of Education of China, 2015
- Tsinghua-GuangHua Scholarship, Tsinghua University, 2013
- National Encouragement Scholarship, Ministry of Education of China, 2010
- National Encouragement Scholarship, Ministry of Education of China, 2009

Academic activities

- Member of the Combustion Institute
- Member of the Young Scholar Committee of the China Electric Power Research Institute Journals Center
- **Reviewer**: Proceedings of the Combustion Institute, Combustion and Flame, Combustion Science and Technology, Fuel, Energy & Fuels, Energy Conversion Management, Power Technology, ACS Omega, Journal of Thermal Science, Frontiers in Energy, Waste and Biomass Valorization, Proceedings of the CSEE (in Chinese), Clean Coal Technology (in Chinese), Asia-Pacific Conference on Combustion, China National Symposium on Combustion.
- **Colloquium chair** and **Session chair** of the 10th International Symposium on Coal Combustion (Aug 7-9, 2023, Taiyuan, China).
- **Session chair** of the China National Symposium on Combustion 2023 (Oct 12-15, 2023, Hefei, China).

Skills

- Analysis of moment closure systems
- Simulation: C++, Fortran, Matlab, Mathematica, ANSYS Fluent, OpenFOAM
- Design and measurement of particle-laden flows in combustion

Courses

- ***Combustion Theory*** (Undergraduate, given by Prof. Shuiqing Li and me during 2020-2023 at Tsinghua University, in Chinese).

Publications

Journal articles

➢ *Kinetic modeling*

[1] **Q Huang**, Y Chen, W-A Yong. Discrete-velocity-direction models of BGK-type with minimum entropy: I. Basic idea. *Journal of Scientific Computing*, 2023, 95: 80.

[2] **Q Huang**, J Koellermeier, W-A Yong. Equilibrium stability analysis of hyperbolic shallow water moment equations. *Mathematical Methods in the Applied Sciences*, 2022, 45: 6459-6480.

[3] **Q Huang**, S Q Li, W-A Yong. Stability analysis of quadrature-based moment methods for kinetic equations. *SIAM Journal on Applied Mathematics*, 2020, 80: 206-231.

[4] Y Chen, **Q Huang***, W-A Yong. Discrete-velocity-direction models of BGK-type with minimum entropy: II. Weighted model. 2023, arXiv:2301.06332.

[5] R Zhang, **Q Huang***, W-A Yong. Stability analysis of an extended quadrature method of moments for kinetic equations. 2023, arXiv:2306.07945.

[6] Y Chen, **Q Huang***, W-A Yong, R Zhang. Poisson quadrature method of moments for 2D kinetic equations with velocity of constant magnitude. 2023, arXiv:2308.10083.

[7] R Zhang, Y Chen, **Q Huang***, W-A Yong. Stability analysis of hyperbolic quadrature method of moments. In preparation.

➢ *Coal combustion*

[1] L Duan, J Wang, **Q Huang***, et al. Experimental investigation on the performance of hybrid electrostatic-fabric precipitators with different structures. *Powder Technology*, 2023, 421, 118404.

[2] L Duan, **Q Huang***, R Ji, S Q Li. A predictive m**odel of synerg**etic particulate-SO_3 removal in ultralow cold-side electrostatic precipitators. *Journal of Aerosol Science*, 2022, 159: 105850.

[3] **Q Huang**, P Ma, Q Gao, S Q Li. Ultrafine particle formation in pulverized coal, biomass and waste combustion: Understanding the relationship with flame synthesis process. *Energy & Fuels*, 2020, 34: 1386-1395.

[4] **Q Huang**, P Ma, L Cai, S Q Li. Kinetic simulation of fine particulate matter evolution and deposition in a 25 kW pulverized coal combustor. *Energy & Fuels*, 2020, 34: 15389-15398.

[5] **Q Huang**, S Q Li, Y Shao, Y Zhao, Q Yao. Dynamic evolution of impaction and sticking behaviors of fly ash particle in pulverized coal combustion. *Proceedings of the Combustion Institute*, 2019, 37: 4419-4426.

[6] **Q Huang**, Y Zhang, Q Yao, S Q Li. Mineral manipulation of Zhundong lignite towards fouling mitigation in a down-fired combustor. *Fuel*, 2018, 232: 519-529.

[7] **Q Huang**, Y Xu, Q Yao, S Q Li. *In situ* diagnostics on the dynamic processes of ash deposit formation, shedding, and heat transfer in a self-sustained down-fired furnace. *Energy & Fuels*, 2018, 32: 4424-4431.

[8] **Q Huang**, S Q Li, G D Li, Q Yao. Mechanisms on the size partitioning of sodium in particulate matter from pulverized coal combustion. *Combustion and Flame*, 2017, 182: 313-323.

[9] **Q Huang**, Y Zhang, Q Yao, S Q Li. Numerical and experimental study on the deposition of fine particulate matter during the combustion of pulverized lignite coal in a 25 kW combustor. *Powder Technology*, 2017, 317: 449-457.

[10] **Q Huang**, S Q Li, G D Li, Y Q Zhao, Q Yao. Reduction of fine particulate matter by blending lignite with semi-char in a down-fired pulverized coal combustor. *Fuel*, 2016, 181: 1162-1169.

[11] Y Yang, **Q Huang**, P Ma, S Q Li. Mechanistic studies on the slagging propensity in low-rank coal combustion. *Combustion and Flame*, 2022, 238: 111956.

[12] P Ma, **Q Huang**, Y Yang, S Q Li. Simultaneous investigation of coal ignition and soot formation in two-stage O_2/N_2 and O_2/CO_2 atmospheres. *Fuel*, 2022, 314: 122808.

[13] Y Xu, **Q Huang**, S Q Li. Numerical investigation of physicochemical effects of CO_2 on coal particle ignition in O_2/CO_2 ambience. *Fuel*, 2021, 287: 119542.

[14] Y Zhao, **Q Huang**, Q Yao, S Q Li. Prediction and validation of ash sticking probability under fouling conditions in pulverized coal combustion. *Proceedings of the Combustion Institute*, 2021, 38: 5311-5318.

[15] M Song, **Q Huang**, F Niu, S Q Li. Recirculating structures and combustion characteristics in a reverse-jet swirl pulverized coal burner. *Fuel*, 2020, 270: 117456.

[16] P Ma, **Q Huang**, Q Gao, S Q Li. Effects of Na and Fe on the formation of coal-derived soot in a two-stage flat-flame burner. *Fuel*, 2020, 265: 116914.

[17] A Adeosum, **Q Huang**, T Li, A Gopan et al. Characterization of a new Hencken burner with a transition from a reducing-to-oxidizing environment for fundamental coal studies. *Review of Scientific Instruments*, 2018. 89(2).

[18] G D Li, S Q Li, **Q Huang**, Q Yao. Fine particulate formation and ash deposition during pulverized coal combustion of high-sodium lignite in a down-fired furnace. *Fuel*, 2015, 143: 430-437.

[19] G D Li, S Q Li, X G Xu, **Q Huang**, Q Yao. Dynamic behavior of biomass ash deposition in a 25kW one dimensional down-fired combustor. *Energy & Fuels*, 2014, 28: 219-227.

[20] Y Yang, **Q Huang***, Y Zhan, S Q Li. Quantitative measurement of the sticking probability of solid-fuel-generated ash particles at elevated temperature. *Journal of Engineering Thermophysics*, 2023, 44(1): 244-249. (in Chinese)

[21] **Q Huang**, S Q Li, G D Li, Q Yao. Simulations of fine particle progressive evolution in a pulverized coal combustor. *Journal of Engineering Thermophysics*, 2014, 35(5): 1026-1029. (in Chinese)

[22] K Wang, **Q Huang**, P Ma, Y Yang, S Q Li. Coupling of population balance model with reactor network in pulverized coal combustion. *Journal of Engineering Thermophysics*, 2024, accepted. (in Chinese)

[23] S Xiao, **Q Huang**, S Q Li. Investigation of droplet combustion characteristics of boron-based nanofluid fuels. *Journal of Engineering Thermophysics*, 2024, accepted. (in Chinese)

[24] Y Li, **Q Huang**, P Ma, R Kneer, S Q Li. Experimental and numerical study on the combustion characteristics of standard swirl flame. *Journal of Engineering Thermophysics*, 2022, 43(4): 1091-1096. (in Chinese)

[25] P Ma, **Q Huang***, H Yan, R Ji, S Q Li. Laser-induced incandescence (LII) diagnostics on sodium-soot interaction in early stage of pulverized coal combustion. *Coal Conversion*, 2022, 45(3): 11-17. http://dx.doi.org/10.19726/j.cnki.ebcc.202203002 (in Chinese)

[26] Y Xu, **Q Huang**, M Song, S Q Li. Theoretical study on the effect of particle spacing on ignition and combustion behavior of pulverized coal particles. *Journal of China Coal Society*, 2022, 47(4): 1701-1708. http://dx.doi.org/10.13225/j.cnki.jccs.2021.0398 (in Chinese)

[27] M Wang, **Q Huang**, W Cao, S Q Li. Numerical investigation on the flow field and performance optimization of the direct air-cooled condenser. *Clean Coal Technology*, 2022, 28(4): 66-74. http://dx.doi.org/10.13226/j.issn.1006-6772.21031102 (in Chinese)

[28] P Ma, **Q Huang**, S Q Li. Effect of soot-mineral interaction on fine particulate formation in pulverized coal combustion. *Journal of Engineering Thermophysics*, 2021, 42(7): 1895-1900. (in Chinese)

[29] M Song, Y Huang, **Q Huang**, S Q Li. Discussion on low-load stable combustion technology of swirl pulverized-coal burner. *Proceedings of the CSEE*, 2021, 41(13): 4552-4565. http://www.pcsee.org/CN/10.13334/j.0258-8013.pcsee.210311 (in Chinese)

[30] K Wang, **Q Huang***, P Ma, Z Wang, S Q Li. Detailed population balance modeling of early-stage fine particle formation in a reactor network of solid fuel combustion. Submitted.

[31] S Xiao, **Q Huang***, Y Li, S Q Li. Effect of addition of energetic boron nanoparticles on ignition, burning and micro-explosion of falling ethanol droplets. Submitted.

➢ *Ammonia combustion*

[1] P Ma, **Q Huang***, T Si, Y Yang, S Q Li. Experimental investigation of NOx emission and

ash-related issues in ammonia/coal/biomass co-combustion in a 25-kW down-fired furnace. *Proceedings of the Combustion Institute*, 2023, 39: 3467-3477.

[2] P Ma, **Q Huang***, Z Wu, J Lyu, S Q Li. Optical diagnostics on coal ignition and gas-phase combustion in co-firing ammonia with pulverized coal on a two-stage flat flame burner. *Proceedings of the Combustion Institute*, 2023, 39: 3457-3466.

[3] J Sun, **Q Huang**, Y Tang, S Q Li. Stabilization and emission characteristics of gliding arc-assisted NH_3/CH_4/air premixed flames in a swirl combustor. *Energy & Fuels*, 2022, 36: 8520-8527.

[4] Y Yang, **Q Huang**, J Sun, P Ma, S Q Li. Reducing NOx emission of swirl-stabilized ammonia/methane tubular flames through a fuel-oxidizer mixing strategy. *Energy & Fuels*, 2022, 36: 2277-2287.

[5] P Ma, H Nicolai, **Q Huang**, et al. Numerical investigation on pyrolysis and ignition of ammonia/coal blends during co-firing. *Combustion and Flame*, 2024, 261: 113268.

[6] Y Di, **Q Huang**, P Ma, F Niu, S Q Li. Experimental investigation on combustion characteristics of cofiring biomass with ammonia. *Proceedings of the CSEE*, 2022, 42(18): 6547-6552. http://www.pcsee.org/CN/10.13334/j.0258-8013.pcsee.220414 (in Chinese)

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[8] Z Wu, **Q Huang**, P Ma, et al. Single-coal-particle ignition in cofiring ammonia with coal. *Clean Coal Technology*, 2023, accepted. https://kns.cnki.net/kcms2/detail/11.3676.TD.20230710.1658.008.html (in Chinese)

[9] Y Li, **Q Huang**, J Sun, R Kneer, S Q Li. Experimental investigation on the effects of air/fuel distribution on stability limit and NOx emission of NH_3/CH_4/air flame. Submitted.

[10] Y Yang, **Q Huang**, P Ma, T Si, S Q Li. Novel methane splitting strategy to reduce NOx emission in staged swirl-stabilized ammonia/methane tubular flames. Submitted.

[11] P Ma, **Q Huang**, Z Wu, et al. Effects of coal rank and particle size on ammonia/coal stream ignition. Submitted.

[12] T Si, **Q Huang**, X Lei, et al. Moisture influence on the ignition behavior for co-firing ammonia with pulverized coal. Submitted.

[13] Y Yang, **Q Huang,** P Ma, T Si, S Q Li. Emission characteristics of fuel-staged swirl-stabilized ammonia/methane tubular flames in a wide range of conditions. Submitted.

[14] B Chen, J Zhuo, **Q Huang**, Y Yang, et al. Ammonia pre-decomposition staged combustion in the methane/air flue gas. Submitted.

[15] Tong S, **Q Huang**, Y Yang, et al. Advancements and future outlook in fundamental research and technological applications for ammonia co-firing with coal. Submitted. (in Chinese)

➢ *AI for power generation techniques*

[1] Z Wang, **Q Huang**, K Wang, S Q Li. Real-time optimization analysis of coal consumption of co-generation units under varied loads. *Proceedings of the CSEE*, 2023, 43: 1347-1358. https://dx.doi.org/10.13334/j.0258-8013.pcsee.222277 (in Chinese)

[2] Z Wang, **Q Huang***, K Wang, et al. Studies on key technology of intelligent big-data cloud platform for coal-fired power plants. *Journal of Chinese Society of Power Engineering*, 2024, accepted. (in Chinese)

[3] X Sha, **Q Huang***, G Liu, S Q Li. Time series analysis of monitored heating surface wall temperature of coal-fired boiler. *Journal of Combustion Science and Technology*, 2021, 27(5): 475-481. (in Chinese)

[4] Z Wang, **Q Huang***, G Liu, et al. Flexibility-oriented safety assessment strategy for air preheater in thermal power units adapting to the advanced power system. *Southern Energy Construction*, 2024, accepted. (in Chinese)

[5] Z Wang, **Q Huang***, K Wang, et al. Knowledge-inspired data-driven prediction of metal overheating risks in flexible utility boilers. Submitted.

Chapters / Conference proceedings

[1] Z Wang, K Wang, **Q Huang***, W Cao, S Q Li. Predicting the minimum load of coal-fired unit limited by the selective catalytic reduction system. 13th Asia-Pacific Conference on Combustion (ASPACC 2021), 2021-December.

[2] P Ma, **Q Huang**, Y Yang, S Q Li. Investigation of coal-derived soot formation characteristics during oxy-coal combustion in reducing-to-O_2/CO_2 ambiences. 13th Asia-Pacific Conference on Combustion (ASPACC 2021), 2021-December.

[3] Y Li, **Q Huang**, Y Yang, P Ma, S Q Li. Experimental and numerical study on the ammonia-coal co-combustion characteristics on a swirl burner. 13th Asia-Pacific Conference on Combustion (ASPACC 2021), 2021-December.

[4] Y Li, **Q Huang***, L Duan, S Q Li. Numerical investigation of fly ash deposition onto tube bundles inside coal-fired boilers. In: Lyu J., Li S. (eds) *Clean Coal and Sustainable Energy*. ISCC 2019. Environmental Science and Engineering. Springer, Singapore. https://doi.org/10.1007/978-981-16-1657-0_17

[5] C Li, **Q Huang***, G Liu, S Q Li. In situ visual monitoring of rotary air preheater blockage: Setup and image analysis. In: Lyu J., Li S. (eds) *Clean Coal and Sustainable Energy*. ISCC 2019. Environmental Science and Engineering. Springer, Singapore. https://doi.org/10.1007/978-981-16-1657-0_65

[6] Z Lyu, **Q Huang***, Y Yang, S Q Li. Technical measures in design and operation of the 1000MW supercritical boiler burning high-slagging-propensity coal. In: Lyu J., Li S. (eds) *Clean Coal and Sustainable Energy*. ISCC 2019. Environmental Science and Engineering. Springer, Singapore. https://doi.org/10.1007/978-981-16-1657-0_80

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[8] **Q Huang**, Q Yao, S Q Li. The progressive ash formation and deposition dynamics in a 25 kW coal combustor. 11th Asia-Pacific Conference on Combustion (ASPACC 2017), 2017-December.

Talks

[1] Title: NOx reduction techniques in co-firing ammonia with fossil fuels. *The 2nd Technical Seminar on Efficient Management of Flue Gas and Green and Low-Carbon Development in Non-ferrous Metal Industry*, Dec 16-17, 2023, Changsha, China.

[2] Title: Prediction and in situ monitoring of ash deposition from burning typical low-rank coal. *China National Symposium on Combustion 2023*, Oct 12, 2023, Hefei, China.

[3] Title: Poisson method of moments for kinetic equations of polar active matter. *Sino-German workshop on advanced numerical methods for hyperbolic balance laws*, Sept 25-27, 2023, Beijing, China.

[4] Title: Stability-preserving quadrature-based moment-closure model hierarchy. Peking University, Sep 13, 2023, Beijing; and Southern University of Science and Technology, Sep 15, 2023, Shenzhen.

[5] Title: Moment methods for a kinetic model of polar active matter. *The Second HKSIAM Biennial Meeting*, Aug 28-Sep 1, 2023, Hong Kong.

[6] Keynote speech: Data centric techniques for safe and efficient operation of coal-fired power units. *The 10th International Symposium on Coal Combustion*, Aug 7-9, 2023, Taiyuan, China.

[7] Title: Quadrature-based moment methods for kinetic equations: Stability analysis & multidimensional models. Academy for multidisciplinary studies, Capital Normal University, Jun 13, 2023, Beijing.

[8] Title: Fine particulate evolution and co-firing with carbon-free fuels in pulverized coal combustion, Institute for Computational Mathematics. Chinese Academy of Science, May 24, 2023, Beijing

[9] Title: Discrete-velocity-direction models of BGK-type with minimum entropy. *NSNMF20*, Mar 31-Apr 2, 2023, Nanjing, China.

[10] Title: Method of moments for solving kinetic equations. *Applied and Computational Math Colloquium* of YMSC, Tsinghua University, Mar 16, 2023.

[11] Title: Discrete-velocity-direction models of BGK-type with minimum entropy. *CSIAM 2022*, Nov 19-20, 2022, held virtually.

[12] Title: Technical and economic analysis of co-firing ammonia with fossil fuels towards carbon neutrality. *The 6th National Yong Scholar Meeting on Combustion Research*, May 21-23, 2021, Hangzhou, China.

[13] Title: Equilibrium stability analysis of hyperbolic shallow water moment equations. *SIAM Conference on Computational Science and Engineering*, Mar 1-5, 2021, held virtually.

[14] Title: Stability analysis of quadrature-based moment methods for kinetic equations. *Sino-German workshop on advanced numerical methods for hyperbolic balance laws*, Sept 25-27, 2019, Beijing, China.

[15] Title: Kinetic simulation of fine particulate matter evolution & deposition inside a 25-kW pulverized coal combustor. *14th International Conference on Energy for a Clean Environment*, Sept 8-12, 2019, Madeira, Portugal.

[16] Title: Numerical & Experimental investigations of ash deposition onto tube bundles in pulverized coal combustion: Impaction & Sticking. *9th International Symposium on Coal Combustion*, July 21-24, 2019, Qingdao, China.

[17] Title: Towards fouling mitigation in the utilization of solid fuel: An active control of fuel property and operation conditions. *10th International Conference on Applied Energy*, August 22-25, 2018, Hong Kong.

[18] Title: Dynamic evolution of impaction and sticking behaviors of fly ash particle in pulverized coal combustion. *37th International Symposium on Combustion*, 29 July-3 August, 2018, Dublin, Ireland.

[19] Title: The progressive ash formation and deposition dynamics in a 25 kW coal combustor. *11th Asia-Pacific Conference on Combustion*, Dec 10-14, 2017, Sydney, Australia.

[20] Title: Impaction and sticking behaviors of ash particles inside a coal-fired furnace. *China National Symposium on Combustion 2017*, Nanjing.

[21] Title: Sub-micron particle formation during pulverized coal combustion in a flat-flame burner. *2016 US Spring Technical Meeting*, May 15-17, 2016, Knoxville.

[22] Title: Mechanisms for the size partitioning of several volatile species in the particulates formed during pulverized coal combustion. *The 9th US National Combustion Meeting*, May 17-20, 2015, Cincinnati.

[23] Title: Dynamic simulations of the alkali vapor-particulate interactions during pulverized coal

combustion. *China National Symposium on Combustion 2014*, Xi'an.

[24] Title: Simulation of fine particle evolution inside a pulverized coal combustor. *China National Symposium on Combustion 2013*, Chongqing.

Patents

[1] **Q Huang**, X Sha, S Q Li, et al. Optimization method and system for air distribution in coal-fired boilers. China Patent Granted, CN202110179184.2.

[2] G Liu, S Q Li, **Q Huang**, et al. A method to monitor the air preheater blockage. China Patent Granted, CN201911218258.8.

[3] S Q Li, M Song, **Q Huang**, et al. Annular wall-heating reversed-jet pulverized coal combustor. China Patent Granted, CN202011026288.1.

[4] S Q Li, M Song, **Q Huang**, et al. A swirl burner and the operation method for flame stabilization based on similarity criteria. China Patent Granted, CN202010181455.3.

[5] S Q Li, M Song, **Q Huang**, et al. A fast-pyrolysis staged-injection probe of ammonia fuel. China Patent Granted, CN202111040556.X.

[6] S Q Li, M Song, J Sun, **Q Huang**. Atmosphere-adjustable multi-staged swirl ammonia burner. USA Patent Granted, 17580504.

Software Copyrights

[1] Software for predicting the load-variation ability of thermal power units V1.0. China Computer Software Copyright, 2022SR0000733.

[2] Software for optimizing NOx removal in flexible operations of coal-fired units V1.0. China Computer Software Copyright, 2022SR0153204.

[3] Software for predicting the initial ash deposition rate onto the heating surfaces in coal-fired units V1.0. China Computer Software Copyright, 2022SR0153244.

[4] Software for predicting the fly ash size distributions from pulverized coal combustion V1.0. China Computer Software Copyright, 2021SR0240152.

[5] Software for analyzing and predicting overheating of boiler surfaces in thermal power units V1.0. China Computer Software Copyright, 2022SR0153203.

[6] Software for predicting the evolution of carbonaceous particles in solid fuel combustion V1.0. China Computer Software Copyright, 2022SR0213903.

[7] Software for predicting the particulates evolution in co-firing ammonia with coal V1.0. China Computer Software Copyright application.

[8] Software for optimizing the coal consumption of CHP units with flexible outputs V1.0. China Computer Software Copyright application.

References

Available upon request