

Personal

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Research Fields and Interests

- Building design with a focus on indoor environment and energy;
- Design of building services for ventilation, heating and domestic hot water systems; Heat and fluid flow investigations in buildings, in building envelopes, in building services and in solar heating systems;
- Active solar heating systems for domestic hot water systems and/or space heating; Different solar collector types including flat-plate solar collectors and evacuated tubular solar collectors; Heat storage for solar heating systems;
- Sustainable building technology;
- CFD (Computational Fluid Dynamics) calculation, flow field measurement and their application to buildings and building services;
- EFD (Experimental Fluid Dynamics) techniques such as PIV (Particle Image Velocimetry) and LDV (Laser Doppler Velocimetry).

Summary of Qualifications

- Teaching experiences in design of building services, teaching experiences in solar heating systems, teaching experience of thermal stratification in solar storage tanks and laboratory course on solar heating systems.
- More than nine years of research experiences on CFD aided design and optimization of industrial processes and research experiences on design of buildings and building services especially solar heating systems.
- Building simulation and building design using TRNSYS (TRAnSient SYstem Simulation Program).
- Experienced with CFD software such as Fluent/Gambit 6.0, CFX 4.4/5.5, Phoenics 2.1/3.2 and ICEMCFD and experienced with EFD such as PIV and LDV.
- Excellent interpersonal & communication skills and good team player.
- Member of International Solar Energy Society.

Skills

Dynamic Simulation of Energy Systems

- Building simulation and design of buildings and building services using TRNSYS.

Computational fluid dynamics

- Geometry construction and mesh generation by means of codes such as AUTOCAD, GAMBIT2.0, CFXBuild, PHOENICS, ICEMCFD.
- Numerical analysis of fluid flow using Fluent6.0, CFX4.4/5.5, Phoenics2.1/3.2.

- Post processing of CFD calculations using Tecplot, Fieldview.
Experimental Fluid Dynamics
- PIV (Particle Image Velocimetry)
- LDV (Laser Doppler Velocimetry)

Education

1. 03/2000 – 07/2004: Ph.D.
The State Key Laboratory of Chemical Engineering,
Department of Chemical Engineering, Tsinghua University, Beijing, P. R. China
2. 09/1997 – 02/2000: M.Sc. in petrochemical engineering
The Key Laboratory of Catalysis, China National Petroleum Corporation
Beijing University of Petroleum, Beijing, P. R. China

Teaching Experience

08/2004 — 07/2006: Assistant professor **08/2006 — Present:** Associate professor
Section of Building Physics and Building Services
Department of Civil Engineering, Technical University of Denmark (DTU), Denmark

Co-supervisor of master thesis projects (08/2004-Present)

Master students: Anne Iversen and Dorthe Kragtig Mortensen

Project title: Integrated Ventilation and Heating System in low Energy Buildings

Project description: The aim of the project is to product develop an integrated ventilation and heating system for low energy buildings. The system shall be able to defrost the heat exchanger, preheat the ventilation air and work as a heating system with heat storage in the concrete floor.

Master student: Lau Raffnsøe

Project title: CFD Modeling of Convection in Air Flow Window.

Project description: The efficiency of the air flow window is mainly dependent on the flow pattern in the cavity and the resulting convective heat transfer coefficients. The plan is to use CFD modeling as the main tool for analyzing the relationship between the specific geometry and external conditions and the heat balance for the window. It is the aim of this project to establish a method for calculating the annual performance of air flow windows.

Master student: Judit Zatykó

Project title: Investigations on the HT Large Solar Collector with and without Teflon.

Project description: The aim of the master thesis project is to develop an improved HT solar collector for large-scale solar heating plants.

Master students: Janne Andersen & Rikke Jørgensen

Project title: Evacuated Tubular Solar Collectors

Project description: Measurements of differently designed evacuated tubular solar collectors utilizing solar radiation from all direction were analyzed. Detailed TRNSYS simulation models for evacuated tubular solar collectors were validated by means of the measurements. Calculations of the yearly thermal performance of the evacuated tubular solar collectors were carried out.

Teaching experiences:

(1) Course title: Technical Building Services 2

DTU Course number: 11114

Credit point: (ECTS) 5

Duration: 13 weeks

Responsibilities:

- Develop the course in English
- Joint principal teacher, responsible for approx. 40% of the teaching load.

Topics of lectures and assignment planned:

- Domestic hot water
- Natural ventilation
- Student assignments and quiz on domestic hot water and on natural ventilation

(2) Course title: CFD on Buildings

DTU Course number: 11124 Credit point: (ECTS) 5 Duration: 13 weeks

Responsibilities:

- Developed the course
- Principal teacher, responsible for 90% of the teaching load

Learning objectives of the course:

- To build up simulation models within the CFD code Fluent for heat and fluid flow investigations in buildings, in building envelopes, in building services or in solar heating systems. It is the objective to make the participants familiar with the use of CFD on building energy: Preprocessing, CFD simulation and post-processing.

Contents of the course and topics of assignments:

- Geometry and mesh creation in 2D and 3D dimensions using Gambit; Solver settings and solution strategy using Fluent; Turbulent flow and turbulent modeling; Heat transfer modeling using Fluent; Post processing;
- Assignments in the following fields: Heat and air flow investigations in rooms, in buildings, in building envelopes, heat and fluid flow investigations in building services including solar heating systems, pipes, ducts or on fire in buildings.

(3) Course title: Solar Heating Systems

DTU Course number: 11117 Credit point: (ECTS) 10 Duration: 13 weeks

Responsibilities:

- Joint principal teacher, responsible for 19% of the teaching load

Topics of lectures and assignment given:

- Solar collector theory and efficiency
- Development and demonstration of a large scale HT (high temperature) solar collector panel
- Flow distribution in a solar collector panel with horizontal fins

(4) Course title: Laboratory Course

DTU Course number: 11761 Credit point: (ECTS) 5 Duration: 13 weeks

Responsibilities:

- Co-supervisor of students of laboratory work on solar collectors, responsible for 0-10% of the teaching load.

(5) Course title: Thermal Stratification in Solar Storage Tanks (PhD course)

DTU Course number: 11610 Credit point: (ECTS) 5 Duration: 2 week

Responsibilities:

- responsible for approx. 30% of the teaching load.

Topics of lectures given:

- Experiments of thermal stratification during charge and draw-off of hot water tanks

- Examples of Modelling Thermal Stratification with Computational Fluid Dynamics (CFD)
- Advanced measurement methods: PIV

(6) Course title: Experimental Methods in Building Energy and Indoor Climate

DTU Course number: 11123 Credit point: (ECTS) 5 Duration: 3 week

Responsibilities:

- responsible for 0-10% of the teaching load.

Topics of lectures given:

- Temperature and flow rate measurements
- Measurement and analysis of the error introduced by temperature delay.

Research Experience

1. 08/2004 — 07/2006: Assistant professor **08/2006 — Present:** Associate professor

Department of Civil Engineering, Technical University of Denmark, Denmark

Ongoing project 1

Title: Development and demonstration of low temperature district heating for low energy buildings.

Financed by Danish Energy Agency, this project aims to develop a design concept for future district heating systems using new technology, materials and operation strategies to reduce total costs and to create a platform for district heating in low energy buildings in Denmark as well as internationally.

Ongoing project 2

Title: Quality assistance to the solar industry in Denmark.

Project finished

- (1) NEGST, New Generation of Solar Thermal Systems.
- (2) Optimization of solar heat production in a liberalized electricity market – a system demonstration.
- (3) Sustainable Arctic Building Technology for the 21st Century- Evacuated Tubular Solar Collector.
- (4) Development, Production and Demonstration of improved ARCON HT-SA Collector

2. 12/2006— Present: CFD Consultant, COWI A/S

Part-time working in COWI A/S as a consultant on CFD analysis of buildings and building services with respect to indoor environment and energy performance.

Project participated

- (1) Computational Fluid Dynamics analysis on the Danish Playhouse (Skuespilhuset)
 - (2) Development of Seeb International Airport
CFD Simulations of Pier, Investigation of Comfort in Pier Lounges, December, 2006.
 - (3) Development of Salalah International Airport: CFD simulation for Gate Lounge, May, 2007
- 3. 04/2000— 07/2004:** Ph.D. student, supervised by Prof. Weiyang Fei

The State Key Laboratory of Chemical Engineering,

Department of Chemical Engineering, Tsinghua University, Beijing, P.R.China

Project finished

- (1) Spatial-temporal Analysis of Fluid Flow in Stirred Tanks
PhD project supported by Nature Science Foundation of China (Grant No.29836130) and

Tsinghua University Basic Research Fund (Grant No.JZ2000080)

- (2) Development of a New Stripping Apparatus for High-efficiency, Energy-saving Distillation with Structured Packings.
- (3) CFD Investigation of Fluid Flow in the Inlet Part of the Reactor for Acrylon Production
Contracted research and training project with Jinshan, Shanghai, Petroleum & Chemical Corporation Sinopec Corp, China.

4. 09/1998 — 01/2000: MSc. Student

The Key Laboratory of Catalysis, China National Petroleum Corporation
Beijing University of Petroleum, Beijing, P.R.China

Project finished

Title: A Study of Fluid Flow in Mist Swirl Separators by means of CFD Modeling and Hydromechanics

Cooperation

- Cooperation with Brødstrup Totalenergi A/S, Arcon Solvarme A/S and PlanEnergi on development of flat plate solar collector for solar heating plants
- Cooperation with Nilan A/S and Metro Therm A/S on development of optimum designed mantle tanks for small solar domestic hot water systems.
- Cooperation on next generation of solar thermal systems with University of Stuttgart, Germany, Hochschule für Technik (SPF), Switzerland, ARSENAL RESEARCH, Austria, TNO, the Netherlands, SP, Sweden, ENEA, Italy, ESTIF, Belgium, INETI, Portugal, NCSR "DEMOKRITOS", Greece, CSTB, France, INTA, Spain, Dalarna University, Sweden, Universität Kassel, Germany, Ecofys B.V., the Netherlands, AEE INTEC, Austria, University of Oslo, Norway and POLIMI, Italy.
- Cooperation with Sunda Solar Energy Technology, China, Exoheat AB, Sweden, Zhejiang University of Technology, China and Meida Solar Energy Technology, China on development of evacuated tubular solar collectors utilizing solar radiation from all directions.
- Cooperation with Tsinghua University, Beijing, China on investigation of flow instabilities in stirred tanks.

International Conference participated

- International Solar World Congress (ISES) 2007, Beijing, China, September 7-21, 2007.
- EuroSun European Solar Congress 2006, Glasgow, UK, June 27-30, 2006.
- International Solar World Congress (ISES) 2005, Orlando, Florida, USA, August 6-13, 2005.

Short Courses & Training

- Dynamic Simulation and Cultural Context of Energy Systems, Dalarna University, Borlänge, Sweden, Jan. 22-31, 2007.
- Teacher Training Course: Education in University Teaching at Technical University of Denmark (DTU), Technical University of Denmark, Kgs. Lyngby, Denmark
Module 1: Learning & Teaching, June 13-15, 2005
Module 2: Planning & Assessment, August 15-17, 2005



CURRICULUM VITAE

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Module 3: Feedback & Documentation, November 09-11, 2005

Module 4: Practical Teaching & Development, January 2006 – June 2007

- How to Write Scientific Papers. Department of Civil Engineering, Technical University of Denmark, March – September, 2006
- Effective Teaching: A Workshop. University of Southern Denmark, Odense, Denmark, April 24, 2006
- CFX-5 Advanced Course (one week), April, 2003, Beijing, Ansys-China
- PIV Training Course (10 days), March, 2002, Beijing, Dantec Company
- CFX-5 Introductory Course (one week), May, 2002, Beijing, ATE Technology Inc China
- Phoenix 3.2 Training Course for Advanced users (5 days), Oct., 2002, Beijing, CHAM Ltd China
- Phoenix 3.2 User Training Course (one week), May, 1999, Shanghai, CHAM Ltd China

Publications in Journals with peer review

1. Jianhua Fan, Simon Furbo. Buoyancy Effects on Thermal Behavior of a Flat Plate Solar Collector, *Solar Energy Engineering*, 2008, Vol.130, 021010, 1-12.
2. Jianhua Fan, L.J. Shah, Simon Furbo. Flow Distribution in a Solar Collector Panel with Horizontally Inclined Absorber Strips. *Solar Energy*, 2007, Vol. 81(12) pp. 1501-1511.
3. E. Andersen, S. Furbo, Jianhua Fan. Investigation of Fabric Stratifiers for Solar Tanks, *Solar Energy*, 2007, Vol. 81(10) pp. 1501-1511.
4. Jianhua Fan, Yundong Wang, Weiyang Fei. Large Eddy Simulations of the Turbulent Flow in a Stirred Tank. *Chinese Journal of Chemical Engineering*, 2007, Vol. 15(2) pp. 200-208.
5. Ning Ai, Jianhua Fan, Jianbing Ji, An overview of CFD and PIV application in investigation of solar thermal systems. *Chemical Industry and Engineering Progress*, 2007, Vol. 26(4) pp. 513-518.
6. Jianhua Fan, Qi Rao, Yundong Wang, Weiyang Fei, "Spatio-temporal Analysis of Macro-instability in a Stirred Tank Reactor via Digital Particle Image Velocimetry (DPIV)", *Chemical Engineering Science*, 2004, Vol. 59 (8-9) pp. 1863-1873.
7. Jianhua Fan, Yundong Wang, Qi Rao, Weiyang Fei, "A Study on Intermittent Phenomena in the Impeller Stream via Digital Particle Image Velocimetry (DPIV)", *Chemical Engineering Journal*, 2004, Vol. 102(1) pp. 25-33.
8. Jianhua Fan, Qi Rao, Yundong Wang and Weiyang Fei, "Spectral Analysis of the Velocity Fluctuations in a Mechanically Stirred Tank", *Journal of Chemical Engineering of Chinese Universities*, 2004, Vol. 18 (3) pp. 287-292.
9. Qi Rao, Jianhua Fan, Yundong Wang, Weiyang Fei, "A DPIV Measurement and CFD Simulation of Viscous Fluid Flow in a Stirred Tank Agitated by a Rushton Turbine", *Journal of Chemical Industry and Engineering*, 2004, Vol. 55 (8) pp. 1374-1379.
10. Jianhua Fan, Qi RAO, Yundong Wang and Weiyang Fei, "Digital PIV Measurement of Flow Fields in a Stirred Reactor Generated by Rushton Turbine", *Journal of Tsinghua University (Sci. & Tech.)*, 2003, Vol. 43(12) pp. 1605-1608.
11. Weisheng Wei, Jianhua Fan, Xiaojun Bao, Gang Shi. Scale-up of Mist Swirl Separators. *The Chinese Journal of Process Engineering*, 2003, Vol. 3 (5) pp. 390-395.

Publications in Conference Proceedings with Peer review

1. Janne Dragsted, Simon Furbo, Jianhua Fan, Solar Heating Systems in the Arctic, *Proceedings of Sustainable Energy Supply in the Arctic*. Sisimiut, Greenland, March 2008.
2. Jianhua Fan, Janne Dragsted, Simon Furbo, Side-by-Side Tests of Differently Designed Evacuated Tubular Collectors, *Proceedings of the 2007 Solar World Congress*. Beijing, China.
3. Jianhua Fan, Janne Dragsted, Simon Furbo, Validation of Simulation Models for Differently Designed Heat-Pipe Evacuated Tubular Collectors, *Proceedings of the 2007 Solar World Congress*. Beijing, China.
4. Jianhua Fan, Simon Furbo. The Effect of Volume Flow Rate on the Efficiency of a Solar Collector. *EuroSun 2006*, Glasgow, UK, 2006.
5. Jianhua Fan, Simon Furbo. Evaluation of the Test Method for Efficiency for Flat Plate Solar Collectors. *EuroSun 2006*, Glasgow, UK, 2006.
6. Yundong Wang, Qi Rao, Jianhua Fan, Weiyang Fei. PIV measurements and CFD simulation of viscous

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- fluid flow in a stirred tank agitated by a Rushton turbine. *Proceedings of the Fifth International Conference on CFD in the Process Industries*. Melbourne, Australia, 2006.
7. Jianhua Fan, L.J. Shah, S. Furbo. Flow Distribution in a Solar Collector Panel with Horizontal Fins. *Proceedings of the 2005 Solar World Congress*. Orlando, USA.
 8. E. Andersen & S. Furbo, Jianhua Fan. Investigation of Fabric Stratifiers for Solar Tanks, *Proceedings of the 2005 Solar World Congress*. Orlando, USA.
 9. Jianhua Fan, Yundong Wang, Weiyang Fei. Large Eddy Simulations of the Turbulent Flow in a Stirred Tank. *Proceedings of the 2005 International Solvent Extraction Conference*. Beijing, P.R. China.

Scientific Reports

1. Jianhua Fan, Louise Jivan Shah, Simon Furbo. Bæredygtigt arktisk byggeri i det 21. århundrede Vakuumsolfangere – Statusrapport 3 til VILLUM KANN RASMUSSEN FONDEN. BYG-DTU Report SR-06-02. 2006.
2. Jianhua Fan, Simon Furbo, Janne Andersen; Rikke Jørgensen, Louise Jivan Shah. Bæredygtigt arktisk byggeri i det 21. århundrede Vakuumsolfangere – Slutrapport til VILLUM KANN RASMUSSEN FONDEN. BYG-DTU Report SR-06-10. 2006.
3. Carsten Rode, Egil Borchersen, Jianhua Fan, Simon Furbo, Jesper Kragh. Lavenergihuset i Sisimiut : Årsrapport for lavenergihusets ydeevne. Juli 2005 til juni 2006. BYG-DTU Report SR-06-12, 2006.
4. Carsten Rode, Egil Borchersen, Jianhua Fan, Simon Furbo, Jesper Kragh. Lavenergihuset i Sisimiut. : Notat om aktiviteter udført som led i KVUG-projekt: Indlejring af erfaringer fra lavenergihus i Sisimiut. - BYG-DTU Report SR-06-13, 2006.
5. Jianhua Fan, Simon Furbo. Effektivitet og flowfordeling for HT solfangere. BYG-DTU Report SR-05-11. 2005.
6. Jianhua Fan, Simon Furbo. Undersøgelse af HT solfangere med og uden teflonfolie. BYG-DTU Report SR-04-12. 2004.