Dr Zhihuo Wang

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PROFILE

I have 4 years postdoctoral research experience after PhD, focusing on control engineering, battery management system, machine learning, with experience in two EU H2020 projects and two Innovate UK projects.

CORE SKILLS

- Control theory, control engineering, and machine learning
- Matlab/Simulink / Python / ANSYS CFD

WORK EXPERIENCE

- **2021 – present Research Fellow, Brunel University London**

  Currently responsible for EU H2020 project in the area of Internet of Things. The machine learning methods - RNN, CNN and reinforcement learning are used for this project.

- **2018 – 2020 Research Fellow of Cranfield University**

  (1) ALISE project: Advanced Lithium Sulfur Battery for xEV

  For this project, a prototype Li-S cell model was integrated with the SEAT vehicle control model. The characterization tests (pulse tests) and performance tests (drive cycle tests) had been carried out for the Li-S cells. The adaptive neuro-fuzzy inference system (ANFIS) estimator was designed for the the state of charge (SoC) estimation.

  (2) LiS:FAB Project: Lithium Sulfur Future Automotive Battery

  Outcome 1: I applied the LSTM RNN model for the task of SoC estimation for fresh Li-S prototype cells. A generic model was applied on three types of cells (LiS, LFP, Solid-State cell). This LSTM RNN model was capable of predicting SoC for multiple types of battery cells using identical structure and parameters, which has shown satisfactory accuracy.

  Outcome 2: I constructed an all-state prediction method using machine learning to predict both of the SoC and battery lifetime. The novelty of predicting multiple states simultaneously using one model saves secondary research investments and time.

  (3) ICP project: Isothermal Control Platform

  I designed a 3-D battery thermal model using CFD software, and a mathematical model using FEM and FDM. This model reflects heat generation, heat distribution, heat conduction process, and surface/tab temperature control ability. I adopted the state-space model to include both the control inputs and the nonlinear factors.

- **Proposals and funding applications**

  (1) H2020-2015: Integrated approach to retrofitting of residential buildings, **(2)** Horizon 2020 EE13: Technology for district heating and cooling, **(3)** Research and Innovation Staff Exchange (RISE) Call: H2020-MSCA-RISE-2015, **(4)** SBRI: using data to better understand and respond to road congestion.

- **2012, Software Engineer with ZTE Corporation**

EDUCATION

2012-2017 PhD, Control Engineering, University of Hull.

2009-2012 MEng, Control Engineering, Northwestern Polytechnical University, China.

2004-2008 BEng, Automation Engineering, Northwestern Polytechnical University, China.

TRAINING

2019 Associate Fellow HEA (Fellow HEA courses are finished);

2014 Postgraduate Certificate in Research Training – teaching assistant for 8 modules.

PUBLICATIONS

1. Xiaoran Feng, Ron Patton and Zhihuo Wang (2014), Sensor fault tolerant control of a wind turbine via Takagi-Sugeno fuzzy observer and model predictive control;
2. Zhihuo Wang, Abbas Fotouhi, and Daniel Auger, State of Charge Estimation of Lithium-Sulfur Cells using LSTM Recurrent Neural Networks, European Control Conference 2020;
3. A journal paper "Generic modelling for battery SoC estimation under an all-state prediction framework using machine learning" drafted;
4. Hales, A., Brouillet, E., Wang, Z., Edwards, B., Samieian, M. A., Kay, J., Mores, S., Auger, D., Patel, Y., Offer, G. Isothermal Temperature Control for Battery Testing and Battery Model Parameterization. SAE International Journal of Electric Vehicles, 10 (2), 2021.

BUSINESSES

I was leading several projects independently and constructed good collaborations with companies and universities. For example, the Oxis Energy, Thermal Hazard Technology, and Imperial College London.

1. Project meetings/ Quarter review meetings, OxisEnergy, 2018-2020, Oxford/Cranfield;
2. Project meetings/ Quarter review meetings, Thermal Hazard Technology, 2018-2020, Bletchley;
3. Poster: *Future Powertrain Conference 2020*, Solihull, UK;
4. Poster: Investigation of Using Lithium-Sulfur Battery in an Electric Bus, 2019;
5. Exhibit: The Battery Show Europe, 28 – 30 April (Postponed), Stuggart, Germany.
6. Project meeting: Varta Automotive Battery, Stuggart, 2018, Germany.
7. CENEX conference and exhibition.
8. European Control Conference, UK Control Conference.

TEACHING AND MSC SUPERVISION

Cranfield University: Vehicle Control Application, Model Predictive Control, Advanced Control Engineering, MSc supervision (2 students).

University of Hull: Teaching assistant for postgraduate & undergraduate modules: (1) Foundation Mathematics, 2013, Semester 2; (2) Foundation Mathematics, 2014, Semester 1; (3) Computers and Applications: Introduction to MatLab; (4) Mathematics with Computer Aided Problem Solving; (5) Engineering Mathematics; (6) Mathematics and Control for Engineers; (7) Mathematics 1 & 2, 2017; (8) 2017 Stress analysis experiment.