Title:
Electric Ferry Power Management and Control

Type:
2017 John Bicknell Scholarship

Value & Duration:
The John Bicknell Scholarship is equivalent to a University of Tasmania Elite scholarship (current APA rate + $7,500 top-up per annum), with additional operational funds of up to $5,000 per annum) for a term of 3 years (with a possible 6 month extension). The scholarship is available to domestic and international applicants, and the awardee must meet or exceed the criteria of a University of Tasmania Elite award. It is awarded on an annual basis, subject to funds being available.

Closing Date:
11:59pm (AEST), Tuesday 31 January 2017

The Research Project:
Ferries play a unique role in transporting passengers, cars and goods in Australia, having more than 80 ferry lines in operation all around the country. The majority of ferries operate close to densely populated areas and hence emission-related health and environmental impacts are significant. Green ferries, powered by fuel-cells, solar cells, batteries and supercapacitors, is the ultimate solution for emission-free ferry transport. Nevertheless, the slow response of fuel cells and the intermittent nature of solar power make battery/supercapacitor hybrid energy storage essential for their stable operation and fast response. These four elements, together with propulsion and service loads, form a small power grid within the ferry which can be considered as a standalone microgrid.

The biggest challenge with such a microgrid is matching the dynamics of each element to the load dynamics while ensuring their robust operation and fast response. Control technologies and power management strategies play a vital role in achieving these objectives. Even though traditional PID controllers are the simplest, their performances are poor in this type of non-linear system. In addition, parameter changes also degrade the performance of PID controllers. Model reference-based control is a good solution for non-linearity and is known to produce a fast response. However, their performance heavily depends upon the accuracy of the model and its parameters. Learning-based control techniques, on the other hand, adopt to parameter changes, but their response is slow.

This project aims to combine model-based and learning-based control techniques in a way that retains the advantages of both while cancelling-out each other’s drawbacks. This yields a new control philosophy for all-electric ferries. The same approach will be extended to develop novel power management strategies and implement them in the proposed all-electric ferry for the optimum use of the fuel cell stack, solar cell array, battery pack and the supercapacitor bank.
**Aims:**

The specific aims of the project can be summarised as follows:

1. Combine model-based and learning-based control methods to develop advanced control technologies for the clean energy sources (fuel cell and solar cell), energy storage systems (battery and supercapacitor) and loads (service loads and propulsion loads) present in the proposed all-electric green ferry;
2. Develop system level supervisory control and coordination strategies based on the combined control approach for the effective integration of each source, energy storage system and load into the ferry power system;
3. Develop combined control approach-based power management strategies for the efficient and optimal use of energy sources in the ferry power system.

**Eligibility:**

The following eligibility criteria apply to this scholarship:

- The scholarship is open to Australian (domestic) candidates and to International candidates.
- The PhD must be undertaken on a full-time basis.
- Applicants must already have been awarded a first class Honours degree or Research Masters degree with at least a Distinction result.
- Applicants must be able to demonstrate strong research and analytical skills.

**Funding:**

This PhD scholarship is funded by the commemorative John Bicknell Scholarship.

**Application Process:**

Applicants requiring more information or who are interested in this specific project should contact the Primary Supervisor listed below.

To determine eligibility, applicants should visit the [Apply Now](#) website and complete an Expression of Interest, which may be found [here](#). Please ensure that a complete list of any publications and awards are included, as well as details of relevant industry experience (including employer name, type of business, employment dates and principal responsibilities). International applications will also need to provide evidence of their English proficiency (such as an IELTS certificate). It is the responsibility of the applicant to obtain supervisor agreement prior to submitting an Expression of Interest, and to ensure that all supporting documentation is submitted prior to the closing date.

Please specify the name of the project advertised into the Project Title field, and indicate under Scholarship Support that you wish to be considered for a living allowance scholarship.

**More Information:**

Please contact Dr Shantha Jayasinghe (shanthaj@utas.edu.au) for more information.