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Project title

Integrated approaches to normally-sequential enterprise-wide optimisation problems

Project number: IMURA0067

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Research Academy theme/s

List only the research academy theme/s that is relevant to the project

1. Advanced computational engineering, simulation and manufacture

The research problem

The modern enterprise has to be a truly global organisation in order to succeed and compete. As production costs become cheaper, countries that are more efficient at manufacturing will carry out manufacturing operations in global supply chains of these global enterprises. As enterprises grow more complex it is no longer possible to look at enterprise-wide operations and optimise these operations in a simple manner. What is required more and more, therefore, is an integrated approach to normally-sequential enterprise-wide optimisation problems, where sub-parts of the operation are actually controlled by external parties. This is also the case in globally distributed enterprises where several sub-parts of the enterprises' operations are carried out in different countries. This research attempts to look at this problem from the point of view of an airline operator, for example. In the airline industry if we at problems such as hub location, fleet planning, route planning, fleet assignment, tail assignment, aircraft maintenance routing and aircrew scheduling/rostering are sequentially made. And so they should, because a combined problem that includes all of the above elements would be far too large and far too complex to solve. There is also this issue of conflicting objectives that need to be resolved when solving a huge, combined problem. Traditionally these problems have been solved sequentially. However, for a while now, I have been thinking through whether some form of iterative approach would help us converge to an overall better, more robust and more optimal solution from an enterprise-wide perspective.

Project aims

The aim of this project is to come up with alternative and better approaches, methods and algorithms for solving sequentially handled enterprise-wide decision problems.

Expected outcomes

The project outcome is expected to be cost minimisation and/or profit maximisation for large distributed global organisations that have several interconnected decision making processes. Another subsidiary outcome of this project is likely to be more robust making in these large organisations because when one decision area is impacted by a change in the operational environment, it would be easier to look at alternatives to subsequent decision problems in the enterprise.

Which of the above Theme does this project address?

Advanced computational engineering, simulation and manufacture

How will the project address the Goals of the above Themes?

Our approach will lead to better optimisation modelling in large organisations. This lies at the heart of complex, modern distributed enterprises. Solutions are required to these hard problems. Our approach will build an abstract mathematical model and arrive at computational algorithms/methods for solving these models. We will test these approaches on data from industry – most likely the airline industry which is a highly competitive industry, especially in the post-deregulation Indian context.