



PhD Proposal 2016

<u>School:</u> Ecole Centrale de Lille	
<u>Laboratory:</u> CRIStAL	<u>Web site:</u> http://cristal.univ-lille.fr/
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Collaboration with other partner during PhD: In China 1: Wang Ting School of Business & Management Guizhou University	In China: Liming ZHANG U. of Macau lmzhang@umac.mo
Title: Optimization of Dynamic Vehicle Routing Problem	
Scientific field: Optimization & Decision Making	
Key words: Optimization, Vehicle Routing Problems (VRP), Real time systems	

• Context:

- Cooperation program between Professors Liming ZHANG (U. of Macau) and A. EL KAMEL (EC Lille/CRIStAL) started in 2013
- Cooperation program between Professors Zhuoyue SONG & Yue YU (Beijing Institute of Technology, BIT) and A. EL KAMEL (EC Lille/ CRIStAL) started in 2012
- Cooperation program between Professors G. GONG (Beihang U., BUAA/AST Key-Lab), S. WANG (Beihang U., BUAA/MC Lab) and A. EL KAMEL (EC Lille/ CRIStAL) started in 2007
- Joint project, involving the 3 partners in the frame of China-French Network LIA 2MCSI
- A. EL KAMEL is Regular Visiting Professor to BUAA since 2008 involved in KEY-Projects, to BIT since 2013 in charge of two courses and to U. of Macau
- Visiting Professor position at EC Lille to G. GONG (2009), to S. WANG (10) & to Z. SONG (15)
- 6 CSC-supported PhD dissertation by Jin ZHAO in 2010, Minzhi LUO in 2012, Yue YU & Tian ZHENG in 2013, Daji TIAN in 2014, Chen XIA in 2015, Bing LIU in 2016
- 3 Chinese PhD students, with CSC support, are now working in my Research Group

Detailed subject

• Background:

The Vehicle Routing Problem (VRP) is one of the most analyzed problems in the fields of transportation, distribution and logistics. The majority of the researches focus on the static and deterministic cases of vehicle routing. However, in most real-life applications, stochastic and dynamic information occurs while routes are being carried out.

As the development of technology and production, new challenges are brought to researchers. On one hand, new techniques such as Electronic Commerce (EC), Global Positioning System (GPS), Intelligence Transport System (ITS), Geographic Information System (GIS) and Global System of Mobile communication (GMS) provide much more information to solve the problem. On the other hand, demands from customers become various. Therefore, it is of great importance to study solutions to large scale dynamic vehicle routing problem. VRP could be applied to the pick-up of courier mail or packages, the dispatching of busses for the transportation of elderly and handicapped people, distribution of oil to private households and so on.

In our research group, two PhD works have been studied this optimization problem. One proposed the specification of the needs based on an Oriented Object UML Modelling, introduced the system architecture based on the RFID technology coupled with the WiFi to locate the customer inside hypermarkets. It also proposed an approach based on Tabu Search method to compute the shortest route to pick items in the shopping list. Thus, when the user enters his shopping list, the system determines his position, locates the items and then computes the shortest path. The other work discusses a problem that many companies face every day: technicians conducting visiting service tours to perform reparations or maintenance operations. The objective is to serve all customers with a minimized cost. The research proposed an approach of hybrid genetic algorithm with diversity management to solve the problem. Moreover, we proposed a system of plan pool to deal with the dynamic information mentioned above.

Research on DVRP is meaningful for both aspects of theory and reality. On one hand, it has always been a spot of operation research and combinatory optimization and involves several domains such as transportation engineering, management and information technology. On the other hand, as the development of e-commerce, it is crucial for enterprises to offer superior logistic services to their customers and at the same time, to reduce the human, transportation and time cost.

□ **Work plan, Research program:**

- Modeling vehicle routing problems
- Design & build advanced UML & EUMML models including real-time aspects
- Developing approaches to optimize the static problem
- Developing methodologies to deal with dynamic information in real-time
- Finding theoretical boundary & theoretical proofs in specific situations
- Simulating the problem with real-world data
- Studying robustness & sensitivity analysis of proposed solutions
- Developing industrial applications

● **References:**

- [1] Hadj Khalifa, A. El Kamel and B. Barfety, Supply chain design for the conception of a real time intelligent navigation system inside hypermarkets, International Conference on Information Systems, Logistics and Supply Chain, ILS 2010, 13-16 Avril, Casablanca, Maroc.
- [2] Hadj Khalifa, A. El Kamel and B. Barfety, Real time indoor intelligent navigation system inside hypermarkets, Large Scale Systems: Theory and Applications, LSS2010, 11-14 Juillet 2010, Lille, France.
- [3] Hadj Khalifa, A. El Kamel and N. Zribi, Itinerary optimisation approach with time windows inside hypermarkets, IEEE International Conference on Systems, Man, and Cybernetics (IEEE-SMC2011), 9-12 Octobre 2011, Anchorage, Alaska.
- [4] Hadj Khalifa, A. El Kamel and N. Zribi, Itinerary optimisation approach inside hypermarkets, International Conference on Intelligent Systems Design and Applications, ISDA2011, 22-24 Novembre 2011, Córdoba, Espagne.
- [5] Y. Liu, Hadj Khalifa and A. El Kamel, 2015, The multi-period and multi-depot field service routing problem with time windows. In IEEE International Conference on Logistics Operations Management (GOL), Fez, Morocco.