
Summary of I-Lin Wang's Research Works

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Outline

- Biography
- Journal Publications
- Publication & Awards Summary
- Projects
- Research Interests
- Detailed Research Topics

Biography

- Undergraduate (87~91) : Aerospace engineering, NCKU
 - Orbital mechanics
- Master (94~96) : Operations Research Center, MIT
 - Premultiplier network simplex algorithm under Prof. Orlin
- Researcher (96~97) : Network system lab, Fujitsu, JP
 - Optical network wavelength routing & assignment algorithm
- Ph.D. (98~03) : ISyE, GA Tech
 - Shortest paths and multicommodity flows under Prof. Johnson
- Assistant professor (03~07) : IIM, NCKU
- Associate professor (07~14) : IIM, NCKU

Publications (1/3)

□ Journal papers

- Wang, I.-L., E.L. Johnson, J.S. Sokol, 2005, [A multiple pairs shortest path algorithm](#), *Transportation Science*, 39(4), pp. 465-476. (SCI/SSCI)
- Sheu, R.L., M.J. Ting, I.-L. Wang, 2006, [Maximum flow problem in the distribution network](#), *Journal of Industrial and Management Optimization*, 2(3), pp. 237-254. (SCI)
- Wang, I.-L., W.-C. Yang, 2007, [Fast Heuristics for Designing Integrated E-Waste Reverse Logistics Networks](#), *IEEE Transactions on Electronics Packaging Manufacturing*, 30(2), pp. 147-154. (SCI)
- Wang, I.-L., 2008, [Distribution of Small Packages in Metropolitan Area by Motorcycle Courier Services](#), *International Journal of Integrated Supply Management*, 4(1), pp. 88-101.
- Wang, I.-L., 2008, [On solving shortest paths with a least-squares primal-dual algorithm](#), *Asia-Pacific Journal of Operational Research*, 25(2), pp. 135-150. (SCI)
- Wang, I.-L., Y.-H. Yang, 2009, [On Solving the Uncapacitated Minimum Cost Flow Problems in a Distribution Network](#), *International Journal of Reliability and Quality Performance*, 1(1), pp. 53-63.
- Wang, I.-L., S.-J. Lin, 2009, [A network simplex algorithm for solving the minimum distribution cost problem](#), *Journal of Industrial and Management Optimization*, 5(4), pp. 929-950. (SCI)

Publications (2/3)

□ Journal papers

- Wang, I.-L., Y.-C. Tsai, F. Li, 2011, [A Network Flow Model for Clustering Pavement Segments with Minimum Total Costs](#), *Computers & Industrial Engineering*, 60(4), pp. 593-601. (SCI)
- Wang, I.-L., C.-Y. Chang, 2011, [Mathematical properties and an integer programming model on haplotyping populations by pure parsimony](#), *Mathematical Biosciences*, 231(2), pp.120-125. (SCI)
- Wang, I.-L., H.-E. Yang, 2011 Apr, [Haplotyping populations by pure parsimony based on compatible genotypes and greedy heuristics](#), *Applied Mathematics and Computation*, 217(23), pp. 9798-9809 (SCI)
- Wang, I.-L., T.H. Yang, Y.-B. Chang, 2012, [Scheduling two-stage hybrid flow shops with parallel batch, release time, and machine eligibility constraints](#), *Journal of Intelligent Manufacturing*, 23(6), pp.2271-2280 (SCI)
- Wang, I.-L., Y.-C. Wang, C.-W. Chen, 2013, [Scheduling unrelated parallel machines in semiconductor manufacturing by problem reduction and local search heuristics](#), *Flexible Services and Manufacturing*, 25(3), pp.343-366 (SCI)

Publications (3/3)

□ Journal papers (by 2013.09.29)

- Shu, J., M.C. Chou, Q. Liu, C.-P. Teo, I.-L. Wang, 2013, [Models for Effective Deployment and Redistribution of Bicycles within Public Bicycle-Sharing Systems](#), *Operations Research*, 61(6), pp.1346--1359 (SCI/SSCI)
- Wang*, I.-L., 2014, [An algebraic decomposed algorithm for all pairs shortest paths](#), *Pacific Journal of Optimization*, 10(3), pp.561-576.
- Wang*, I.-L., J.-C. Lin, 2016, [A compaction scheme and generator for distribution networks](#), *Journal of Industrial and Management Optimization*, 12(1), pp.117-140.
- Wang*, I.-L., Y. Wang, P.-C. Lin, 2016, [Optimal recharging strategies for electric vehicle fleets with duration constraints](#), *Transportation Research Part C*, 69(8), pp.242-254.

Publications & Awards Summary

- **Summary of publications** (by 2018.01)
 - Int. Journal: 16 (SCI/SSCI: 14; non-SCI: 2)
 - Int. Conference (outside TW): 25
 - Int. Conference (inside TW): 27
 - Dom. Conference: 36
- **Awards Received** (by 2018.01; from 38 master students; 5 undergraduate groups)
 - INFORMS RAS Problem Solving Competition Award
 - 6 awards (1 1st; 2 2nd; 1 3rd; 2 honorable mentions)
 - Master Thesis / Best Paper Awards (served as thesis advisor / co-author)
 - 38 awards (10 1st; 2 2nd; 1 3rd; 1 4th; 13 honorable in thesis awards; 11 best of papers)
 - Undergraduate Projects Awards (served as thesis advisor / coauthor)
 - 9 awards (3 1st; 1 2nd; 2 honorable; 3 MOST/NSC best projects)
 - Other Awards
 - 2 NSC poster awards ; 1 Lu Feng-Chang medal; 3 Outstanding Young Researcher (by NSC IE, TCUS, & MS@KHH)

Students & Awards by 2018.01

	Students Advised						Awards Received					By 2018.01
	IIM		IM		EIIM		UGA		MSA		MyA	38 graduated master students (11 IIM+ 12 IM + 4 EIIM; 21 M + 17 F)
	M	F	M	F	M	F	GP	ID	CF	TH		38 master paper awards (12 cf. paper + 26 thesis comp); 12 personal awards
	11	11	7	5	3	1	5	4	12	26	12	9 undergraduate project awards (5 group + 4 individual)
2019	[2]	[2]	[1]		[1]	[1]						Current 1st yr master students
2018	[1]	[1]			[2]	[1]						Current 2nd yr or older master students
2017		1		1				1	2		1	MOST(U,1F,1); CIIEA(M,1)*2; RAS(1)
2016	2		1		1		1			6	1	ORSTW(U,2M3F,H); FB(M,H)*2, FB(M,1), CIIE(M,1), CIIE(M,H)*2; RAS(2)
2015	2						1	2		5		CIIE(U,4F,H), MOST(U,1F,1)*2; FB(M,H)*2, FB(M,1), CIIE(M,H), CIIE(M,1);
2014				1	1				1		1	CIIEA(M,1); RAS(2)
2013	1	1	1		1					3	4	ORSTW(M,H)*2, CIIE(M,1); RAS(H), NSC(Young), TCUS(Young, H), MS(LFC)
2012		1				1			1	1	2	; TSA(M,3), CIIE(M,1); TS(M,3), MS(KHH,1)
2011		1	1						4	1	1	; CIIEA(M,1)*2, ORSTWA(M,1), ORSTW(M,H), ICLS(M,1); RAS(3)
2010		4	1				2		1	3	1	CIIE(U,1M3F,1), CE(U,1M3F,H); CIIEA(M,1), CIIE(M,1), ORSTW(M,2), ORSTW(M,H); RAS(H)
2009	2							1	3	1	1	ORSTW(U,1F,1); CIIEA(M,1), CIIEA(M,H), Auto(M,1), ORSTW(M,1); NSC(poster,1)
2008	1	2	2	1			1			4		ORSTW(U,4F,2); CIIE(M,H), DHL(M,1), ORSTW(M,2), ORSTW(M,H);
2007			1									::
2006	2			1						1		ORSTW(M,1); ;
2005	1	1		1						1		ORSTW(M,4); ;

Projects (1/5)

□ NSC Research Projects (1/2)

- Multiple Pairs Shortest Paths Algorithms
NTD 362,800 NSC 92-2213-E-006-094
- New column generation and partitioning methods for multicommodity network flow problems
NTD 509,900 NSC 93-2213-E-006-096
- New nonnegative least squares primal-dual methods for network optimization problems
NTD 150,000 NCKU 950104
- On solving the minimum distribution cost flow and maximum distribution flow problems
NTD 651,000 NSC 95-2221-E-006-268
- Haplotyping population by optimization theorems and algorithms (I)
NTD 590,000 NSC 96-2221-E-006-015
- Haplotyping population by optimization theorems and algorithms (II)
NTD 585,000 NSC 97-2221-E-006-173

Projects (2/5)

□ NSC Research Projects (2/2)

- A Study on Reliability for Distribution Networks with Multi-state Capacitated Arcs
NTD 1,279,000 NSC 98-2410-H-006-115-MY2
- A Study on the Network Design and Bike Repositioning for Urban Bike Sharing Systems
NTD 984,000 NSC 100-2410-H-006-006-MY2
- Design and Repositioning Strategies for the Public Bike and E-scooter Sharing Systems (Outstanding Young Researcher Grant)
NTD 2,124,000 NSC 102-2221-E-006-141-MY3
- On scheduling multi-mode restoration tasks for networks of broken nodes or arcs in humanitarian logistics
NTD 2,326,000 NSC 105-2221-E-006-182-MY3

Projects (3/5)

□ NSC Undergraduate Student Projects (大專生專題計畫) (1/2)

- Design of a Trip Planning Decision Support System for Public Transportation in a Metropolitan Area
NTD 47,000 NSC 96-2815-C-006-065-H
- Computational Experiments by a Dual-Primal Non-negative Least Squares Method for Maximum Flow Problems
NTD 47,000 NSC 97-2815-C-006-031-E
- Planning Optimal Bike Routes based on Target Calories Burned
NTD 47,000 NSC 98-2815-C-006-107-H
- Solving the tagSNP Selection Problem by Bi-objective Programming
NTD 47,000 NSC 98-2815-C-006-048-E
- A Simulation Study on the Management of Public E-scooter Sharing Systems for Commuters
NTD 47,000 NSC 101-2815-C-006-063-E

Projects (4/5)

□ NSC Undergraduate Student Projects (大專生專題計畫) (2/2)

- Selecting Facility Locations via Google Map with an application for the Public Bike Sharing System (Best Project Report Award)
NTD 47,000 NSC 103-2815-C-006-087-E
- On Implementing a Simulation System for Public Bicycle Sharing Systems (Best Project Report Award)
NTD 47,000 NSC 103-2815-C-006-013-H
- A Simulation and Visualization Study on the Dynamics of Public Bicycle Sharing System (Best Project Report Award)
NTD 47,000 NSC 103-2815-C-006-013-H

Projects (5/5)

□ Industry Project

- 300mm晶圓廠即時性生產排程系統導入(TSMC) 2008.04.01~2008.12.31
NTD 500,000
- 臺南市觀光自行車系統設置規劃案 2012.08.08~2012.12.05
NTD 450,000
- 生產流程改善計畫 (Tacheng) 2015.01.01~2015.06.30
NTD 500,000
- 宏遠興業導入工業4.0對生產營運之影響研究 2016.06.01~2016.11.30
NTD 310,000
- 需求反應最佳化數學模式研究 (ITRI) 2016.06.01~2016.11.30
NTD 200,000

Research Interests (1/3)

□ Network Optimization

- Shortest Path
- Maximum Flows
- Min-cost Flows
- Multicommodity Network Flows
- Distribution Networks (D-node)

□ Logistics, Supply Chain Management

- Reverse Logistics Network Design
- Metropolitan Motorcycle Courier Systems
- Public Bicycle Sharing Systems

□ Bioinformatics

- Haplotype Inference
- TagSNP Selection

Research Interests (2/3)

□ Personal Navigation

- Quickest Itinerary Planning with/without Timetable
- Minimum Fare Itinerary Planning without Timetable
- Optimal Biking Routes with a Target Range of Calorie Consumption
- Optimal Euler Subgraphs of bounded lengths

□ Network Reliability

- Reliability for Multi-state Capacitated Manufacturing Networks with Distillation Process

□ Semiconductor Manufacturing

- 1-stage Complex Job-Shop Scheduling with recipe, release time, due date, and setup time consideration
- 2-stage Complex Job-Shop Scheduling with recipe, release time, due date, and batch process (2 jobs of the same recipe) consideration

□ Data Mining

- Change Mining

Research Interests (3/3)

□ Project Management

- Stable project baseline schedules with time constraints

□ Staff Rostering

- Designing a Nurse Rostering Information System for Site Management Organizations
- Railway Staff Rostering and Re-rostering Problem

□ Pavement Optimization

- Project level
- Network level

□ Telecommunication

- Optimal wavelength assignment & routing algorithm
- Sensor Network

Network Optimization (1/2)

□ Shortest Path:

- Multiple Pairs Shortest Path (MPSP) algorithms, $O(n^3)$, [paper](#)
- Primal-Dual Nonnegative Least Squares algorithm (PDNNLS) == Dijkstra's method, for nonnegative arc lengths, [paper](#)
- All Pairs Shortest Path (APSP) algorithm, $O(n^3)$, [manuscript](#)
- Computational Experiments on MPSP algorithms, [manuscript](#)

□ Maximum Flows:

- DPNNLS algorithm, solve the max-flow by Kirchhoff's laws, $O(m^5n)$; Augment flows proportionally, $O(mn^2)$

Network Optimization (2/2)

□ Min-cost flows:

- premultiplier network simplex algorithm (my [master thesis](#))

□ Multicommodity Network Flows: (my [ph.d. thesis](#))

- comprehensive survey
- primal-dual column generation method

□ Minimum Distribution Cost Problem: (Distillation, D-node)

- shortest path, UMDCP1, UMDCP2, UMDCP3 , [paper](#)
- max-flow & generator
- min-cost network simplex method, detailed graphical operations, [paper](#)

Logistics, Supply Chain Management (1/3)

□ Reverse Logistics Network Design

- facility location with different configurations; greedy heuristics, [paper](#)

□ Metropolitan Motorcycle Courier Systems

- Monopoly performance estimation, [paper](#)
- Cournot game, 2 competitors, 4 scenarios (HS, PP)
- determine the most profitable HQ/LQ service percentages
- *new network models without hub

Logistics, Supply Chain Management (2/3)

□ Public Vehicle Sharing Systems (mostly on bikes)

- site location selection
- bike transshipment management to satisfy demand
- bike transshipment management considering advertisement exposure
- persistency model in site location (a QIP)
- dynamic bike repositioning based on proportional demands
- simulations for evaluating info sharing
- temporary manpower allocation vs. self bike repositioning
- E-scooter sharing systems
- Repositioning in free float mechanism (staff rebalancing, crowdsourcing repositioning)
- Rideshare matching
- Parking space sharing

Logistics, Supply Chain Management (3/3)

□ Humanitarian Logistics

- Evacuation
- Road restoration
- Underground pipeline restoration
- Time-dependent demands
 - Nodes only vs. node pairs (telecommunication, YouBike)

Routing by UAV/USV or Patrolling

□ Patrol routing by UAV

- K-WRPP: min-max, max patrol affects, mutual coverage

□ USV routing

- Time-dependent moving speed (e.g., Wind/Tide)

□ Security Deployment over moving trains in rail transit system

- Network interdiction

Bioinformatics

□ Haplotype Inference [manuscript](#)

- compatible relation, merged genotype pairs (MGP)
- greedy selection with Clark's rule

□ TagSNP Selection

- programming to select tagSNPs with labi-objective mathematical rger LD values
- Lagrangian Relaxation heuristics
- IP model to select robust tagSNPs for capacitated bio-chips

Personal Navigation Systems

- **Quickest Itinerary Planning without Timetable**
 - modeled as a constrained shortest path problem, given max # transfers
 - LR, KSP, preprocessing
- **Quickest Itinerary Planning with Timetable**
 - without transfer upper bounds, with/without Walk
 - shortest path on an acyclic graph, topological ordering algorithm with BFS/DFS speed-up techniques
- **Minimum Fare Itinerary Planning without Timetable**
 - shortest path on a complete graph, Dijkstra's algorithm with BFS/DFS speed-up techniques
 - models for special cases such as one free transfer after MRT, or "2-stage" bus routing in a single trip
- **Optimal Biking Routes with a Target Range of Calorie Consumption**
- **Optimal Euler Subgraphs of bounded lengths**

Network Reliability

- Reliability for Multi-state Capacitated Manufacturing Networks with Distillation Process
 - a compaction preprocessing scheme
 - algorithms to calculate the reliability (difficulty: fractional flow, flow dependency)
 - min-cost network design with given reliability lower bound
- *Approximation algorithm for calculating reliability

Semiconductor Manufacturing

- 1-stage Complex Job-Shop Scheduling with recipe, release time, due date, and setup time consideration [manuscript](#)
 - MIP formulation, problem decomposition (into single stages)
 - greedy dispatching rule (load balance), heuristics to reduce the number of variables
 - heuristics that involves more scheduling rather than dispatching
- 2-stage Complex Job-Shop Scheduling with recipe, release time, due date, and batch process (2 jobs of the same recipe) consideration
 - MIP formulation, problem decomposition (into single stages)
 - greedy dispatching rule (FIFO)
 - heuristics that involves more scheduling rather than dispatching

Data Mining

□ Change Mining

- given possible interruption duration with probability distribution, time-window

Project Management

- **stable project baseline schedules with time constraints**
 - given possible interruption duration with probability distribution, time-window & time-schedule constraints, 2 greedy heuristics & GA
 - project network generator

Staff Rostering

- Designing a Nurse Rostering Information System for Site Management Organizations
 - MIP formulation, greedy heuristics
 - an information system to verify schedules
- Railway Staff Rostering and Re-rostering Problem
 - MIP formulation, greedy heuristics

Pavement Optimization

- With Prof. Tsai in Civil Eng., GA Tech
- **Project level (detailed work plan: which treatment, when, where)**
 - segment clustering, give a network model, solved by topological ordering algorithm
 - with reliability idea, how to make a work plan such that the road condition meets the quality requirement with min-total-cost (also integrating the network level Markovian idea)
 - budget balance between working districts and political districts
- **Network level**
 - MIP formulation, how to allocate budget

E-learning

□ Grouping for better cooperative learning

- MIP formulation that groups students for cooperative learning
- considering mutual compensation based on conceptual graph and other criteria



Telecommunication

- Optimal wavelength assignment & routing algorithm
- Sensor Network
 - sensor network localization problem



Thank you !

Q & A

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