A flexible metaheuristic framework for solving rich vehicle routing problems

Inauguraldissertation
zur Erlangung des Doktorgrades
der Wirtschafts- und Sozialwissenschaftlichen Fakultät
der Universität zu Köln

2011

vorgelegt von

Dipl.-Wirt.-Inf. Ulrich Vogel

aus Hürth

Referent:	Prof. Dr. Dr. Ulrich Derigs
Korreferent:	Prof. Dr. Dirk Briskorn
Tag der Promotion:	16.12.2011

Wirtschaftsinformatik und Operations Research

Band 17

Ulrich Vogel

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D 38 (Diss. Universität Köln)

Shaker Verlag
Aachen 2012

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

Zugl.: Köln, Univ., Diss., 2011

Printed in Germany.

ISBN 978-3-8440-0674-2
ISSN 1433-8521

Shaker Verlag GmbH • P.O. BOX 101818 • D-52018 Aachen
Phone: 0049/2407/9596-0 • Telefax: 0049/2407/9596-9
Internet: www.shaker.de • e-mail: info@shaker.de

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List of Abbreviations and Symbols

2L-CVRP	Capacitated vehicle routing problem with two-dimensional loading constraints
3L-CVRP	Capacitated vehicle routing problem with three-dimensional loading constraints
ABHC	Attribute based hill climber
AMP	Adaptive memory programming
ARP	Arc routing problem
BKS	Best known solution(s)
CMT	Set of testing instances by Christofides et al. (1979)
CV	Coefficient of variation
CVRP	Capacitated vehicle routing problem
DDM	Dialog, data, models
DSS	Decision support system
DVRP	Dynamic vehicle routing problem
FSMVRP	Fleet size and mix vehicle routing problem
GDA	Great deluge algorithm
GIS	Geographic information system
GIST	Greedy indirect search technique
GLS	Guided local search
GPS	Global positioning system

GWKC	Set of testing instances by Golden et al. (1998)
HVRP	Heterogeneous vehicle routing problem
HYBRID-ABHC	ABHC heuristic with LS neighborhoods and LNS moves
HYBRID-RRT	RRT heuristic with LS neighborhoods and LNS moves
LNS	Large neighborhood search
LNS-RRT	RRT heuristic with LNS moves
LS	Local search
LS-ABHC	ABHC heuristic with LS neighborhoods
LS-RRT	RRT heuristic with LS neighborhoods
MDVRP	Multi-depot vehicle routing problem
Mflop/s	Million floating point operations per second
MP-VRP	Multi-pile vehicle routing problem
NV	Number of vehicles
OOP	Object-oriented programming
OR	Operations research
OVRP	Open vehicle routing problem
PDP	Pickup and delivery problem
PDPTW	Pickup and delivery problem with time windows
pkm	Passenger-kilometer
PVRP	Periodic vehicle routing problem
RPDPTW	Rich pickup and delivery problem with time windows
RRT	Record-to-record travel
SA	Simulated annealing
SD	Steepest descent

SDVRP	Split delivery vehicle routing problem
TA	Threshold accepting
TD	Total distance
TDVRP	Time-dependent vehicle routing problem
tkm	Tonne-kilometer
TS	Tabu search
TSP	Traveling salesman problem
TTRP	Truck and trailer routing problem
VNS	Variable neighborhood search
VRP	Vehicle routing problem
VRPB	Vehicle routing problem with backhauls
VRPC	Vehicle routing problem with compartments
VRPM	Vehicle routing problem with multiple use of vehicles
VRPPD	Vehicle routing problem with pickups and deliveries
VRPTT	Vehicle routing problem with trailers and transshipments
VRPTW	Vehicle routing problem with time windows
A	Set of ABHC attributes
$A(S)$	Set of ABHC attributes of a solution
A^e	Set of entering ABHC attributes
$\bar{A}^e$	Set of entering ABHC attributes (problem-specific)
A^l	Set of leaving ABHC attributes
$\bar{A}^l$	Set of leaving ABHC attributes (problem-specific)
$amem$	ABHC attribute memory
C	Set of compartments

C_i	Set of customer visit combinations
c_{ij}	Arc cost
$cost(S)$	Solution cost
$customers(t)$	Set of customers visited during a tour
d	Depot
e_i	Begin of customer time window
$\mathcal{F}$	Set of feasible solutions
f_i	Customer service frequency
$\mathcal{I}$	Set of insertion heuristics
I^{pc}	Set of product/compartment incompatibilities
I^{pp}	Set of product/product incompatibilities
l_i	End of customer time window
$locations(t)$	Set of locations visited during a tour
m	Maximum number of vehicles
m_k	Maximum number of trucks
m_l	Maximum number of trailers
$\mathcal{N}$	Set of neighborhoods
N	Set of nodes/locations
N_c	Set of customers
$N(S)$	Set of neighbors of a solution
$N(S, i)$	Set of neighbors reachable by a move involving a specific customer
O_i	Set of orders placed by a customer
P	Set of products
p^{LS}	Probability of LS move in a hybrid method

p_o	Order product type
Q	Vehicle capacity
Q_c	Compartment capacity
Q_k	Truck capacity
Q_l	Trailer capacity
q	Number of customers removed in LNS
q_i	Customer demand
q_o	Order quantity
$\mathcal{R}$	Set of removal heuristics
$R(i,j)$	Shaw removal relatedness between two customers
r	Removal percentage in LNS
s_i	Customer service time
T	Maximum travel duration
t	Number of periods in planning horizon
t_{ij}	Arc travel time
$tours(S)$	Set of tours of a solution
V	Set of vehicles
β	LS-RRT randomization
β^{SR}	Shaw removal randomization
β^{STR}	Subtour removal randomization
β^{WR}	Worst removal randomization
Δ	Cost increase
$\bar{\Delta}$	Cost increase (problem-specific)
δ	RRT deviation

Φ	Problem-specific information
Φ^s	Problem-specific sequence-level information
Φ^t	Problem-specific tour-level information
φ	Shaw relatedness weight for distance
χ	Shaw relatedness weight for time windows
ψ	Shaw relatedness weight for demand
ω	Shaw relatedness weight for product type