

ISSN: 2160-8830 Volume 8, Number 3, May 2018



# American Journal of Operations Research



ISSN: 2160-8830



[www.scirp.org/journal/ajor](http://www.scirp.org/journal/ajor)

# Journal Editorial Board

ISSN 2160-8830 (Print) ISSN 2160-8849 (Online)

<http://www.scirp.org/journal/ajor>

---

## Editor-in-Chief

Prof. Jinfeng Yue

Middle Tennessee State University, USA

## Editorial Advisory Board

Prof. Bintong Chen  
Prof. Wade D. Cook  
Prof. Shu-Cherng Fang  
Prof. Panagiotis Kouvelis  
Prof. Lawrence M. Seiford

University of Delaware, USA  
York University, Canada  
North Carolina State University, USA  
Washington University in St. Louis, USA  
University of Michigan, USA

## Editorial Board

Dr. Javier De Andrés  
Prof. Janine E. Aronson  
Dr. Annamaria Barbagallo  
Dr. Nabil Belacel  
Prof. Ignacio Castillo  
Prof. Xu Chen  
Prof. Muhammad El-Taha  
Dr. Carmen Galé  
Prof. Xianghua Gan  
Prof. Bibhas Chandra Giri  
Prof. Xiuli He  
Prof. Mhand Hifi  
Prof. Zhimin Huang  
Prof. Zhibin Jiang  
Dr. Ricardo Josa-Fombellida  
Prof. Nguyen Khac Minh  
Prof. Dennis Leech  
Prof. Dengfeng Li  
Prof. Liang Liang  
Dr. Pedro Lorca  
Prof. Charles L. Munson  
Dr. Jamal Ouenniche  
Prof. Joaquín Antonio Pacheco Bonrostro  
Prof. Javier Ramirez Rodriguez  
Prof. Bhaba R. Sarker  
Prof. Renduchintala Raghavendra Kumar Sharma  
Dr. Chunming (Victor) Shi  
Prof. Andranik Tangian  
Prof. Etsuji Tomita  
Prof. Delfim F. M. Torres  
Dr. Manish Verma  
Dr. Yu Amy Xia  
Dr. Shenghan Xu  
Dr. Jiping Yang  
Dr. Shilei Yang  
Prof. Peng-Yeng Yin  
Dr. Xiaohang Yue

University of Oviedo, Spain  
University of Georgia, USA  
University of Naples “Federico II”, Italy  
NRC Institute for Information Technology, Canada  
Wilfrid Laurier University, Canada  
University of Electronic Science and Technology of China, China  
University of Southern Maine, USA  
University of Zaragoza, Spain  
The Hong Kong Polytechnic University, China  
Jadavpur University, India  
The University of North Carolina at Charlotte, USA  
University of Picardie Jules Verne, France  
Adelphi University, USA  
Shanghai Jiao Tong University, China  
University of Valladolid, Spain  
Thang Long University, Vietnam  
University of Warwick, UK  
Fuzhou University, China  
University of Science and Technology of China, China  
University of Oviedo, Spain  
Washington State University, USA  
University of Edinburgh, UK  
University of Burgos, Spain  
The Metropolitan Autonomous University, Mexico  
Louisiana State University, USA  
IIT Kanpur, India  
Wilfrid Laurier University, Canada  
Karlsruhe Institute of Technology, Germany  
The University of Electro-Communications, Japan  
University of Aveiro, Portugal  
McMaster University, Canada  
Northeastern University, USA  
University of Idaho, USA  
Beihang University, China  
Southwestern University of Finance and Economics, China  
National Chi Nan University, Chinese Taipei  
University of Wisconsin-Milwaukee, USA

# Table of Contents

**Volume 8    Number 3**

**May 2018**

## **Solving the Traveling Salesman Problem Using Hydrological Cycle Algorithm**

A. Wedyan, J. Whalley, A. Narayanan.....133

## **Topology Abstraction Service for IP VPNs: Core Network Partitioning for Resource Sharing**

R. Ravindran, C. C. Huang, K. Thulasiraman, T. C. Lin.....167

## **Optimization of Medical Supply Chains and Forward Store Locations for Recurrent Homecare Patient Demand with Periodic Interruptions**

R. P. Radha Krishnan, J. C. Benneyan, S. B. Sonuc.....203

## **Design of Expressway Toll Station Based on Neural Network and Traffic Flow**

Y. Q. Huang, L. Chen, Y. W. Xia, X. L. Qiu.....221

# American Journal of Operations Research (AJOR)

## Journal Information

### SUBSCRIPTIONS

The *American Journal of Operations Research* (Online at Scientific Research Publishing, [www.SciRP.org](http://www.SciRP.org)) is published bimonthly by Scientific Research Publishing, Inc., USA.

#### **Subscription rates:**

Print: \$79 per issue.

To subscribe, please contact Journals Subscriptions Department, E-mail: [sub@scirp.org](mailto:sub@scirp.org)

### SERVICES

#### **Advertisements**

Advertisement Sales Department, E-mail: [service@scirp.org](mailto:service@scirp.org)

#### **Reprints (minimum quantity 100 copies)**

Reprints Co-ordinator, Scientific Research Publishing, Inc., USA.

E-mail: [sub@scirp.org](mailto:sub@scirp.org)

### COPYRIGHT

#### **Copyright and reuse rights for the front matter of the journal:**

Copyright © 2018 by Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY).

<http://creativecommons.org/licenses/by/4.0/>

#### **Copyright for individual papers of the journal:**

Copyright © 2018 by author(s) and Scientific Research Publishing Inc.

#### **Reuse rights for individual papers:**

Note: At SCIRP authors can choose between CC BY and CC BY-NC. Please consult each paper for its reuse rights.

#### **Disclaimer of liability**

Statements and opinions expressed in the articles and communications are those of the individual contributors and not the statements and opinion of Scientific Research Publishing, Inc. We assume no responsibility or liability for any damage or injury to persons or property arising out of the use of any materials, instructions, methods or ideas contained herein. We expressly disclaim any implied warranties of merchantability or fitness for a particular purpose. If expert assistance is required, the services of a competent professional person should be sought.

### PRODUCTION INFORMATION

For manuscripts that have been accepted for publication, please contact:

E-mail: [ajor@scirp.org](mailto:ajor@scirp.org)





*Call for Papers*

# American Journal of Operations Research

ISSN 2160-8830 (Print) ISSN 2160-8849 (Online)

<http://www.scirp.org/journal/ajor>

AJOR is an international scientific journal dedicated to the publication and public discussion of high quality, original papers that contribute to the methodology of operational research and to the practice of decision making.

## Editor-in-Chief

**Prof. Jinfeng Yue**

Middle Tennessee State University, USA

## Editorial Board

Dr. Javier De Andrés  
Prof. Janine E. Aronson  
Dr. Annamaria Barbagallo  
Dr. Nabil Belacel  
Prof. Ignacio Castillo  
Prof. Xu Chen  
Prof. Muhammad El-Taha  
Dr. Carmen Galé  
Prof. Xianghua Gan  
Prof. Bibhas Chandra Giri  
Prof. Xiuli He  
Prof. Mhand Hifi  
Prof. Zhimin Huang

Prof. Zhibin Jiang  
Dr. Ricardo Josa-Fombellida  
Prof. Nguyen Khac Minh  
Prof. Dennis Leech  
Prof. Dengfeng Li  
Prof. Liang Liang  
Dr. Pedro Lorca  
Prof. Charles L. Munson  
Dr. Jamal Ouenniche  
Prof. Joaquín Antonio Pacheco Bonrosto  
Prof. Javier Ramirez Rodriguez  
Prof. Bhaba R. Sarker  
Prof. Renduchintala Raghavendra Kumar Sharma

Dr. Chunming (Victor) Shi  
Prof. Andranik Tangian  
Prof. Etsuji Tomita  
Prof. Delfim F. M. Torres  
Dr. Manish Verma  
Dr. Yu Amy Xia  
Dr. Shenghan Xu  
Dr. Jiping Yang  
Dr. Shilei Yang  
Prof. Peng-Yeng Yin  
Dr. Xiaohang Yue

## Subject Coverage

**This journal invites original research and review papers that address the following issues in operations research. Topics of interest include, but are not limited to:**

### 1. Operations Research and Optimization Theory and Research Technical Approaches

Computational Intelligence and Information Management  
Continuous Optimization  
Decision Support Systems, Multi-Criteria Decision Methods  
Discrete Optimization  
Expert Systems  
Heuristics Mathematical Programming  
Networks  
Queues  
Simulation  
Stochastic Models and Statistics  
Time Series Analysis

### 2. Manufacturing and Service Operations Research

Forecasting  
Inventory  
Location  
Logistics, Transportation Warehousing and Maintenance  
Planning and Scheduling  
Product and Service Design

Project Management  
Quality Management  
Revenue Management  
Supply Chain Management

### 3. Interfaces with Other Disciplines

Community Operations Research  
Complex Systems  
Education Operations Research  
Environmental and Energy Issues  
Financial Engineering  
Government Operations Research  
Health Services Operations Research  
Marketing Science  
Military and Homeland Security  
Operations Research in Nonprofit Organization  
Policy Modeling and Public Sector OR  
Productivity and Efficiency in the Public Sector  
Sports Operations Research  
Telecommunications and Networking

We are also interested in short papers (letters) that clearly address a specific problem, and short survey or position papers that sketch the results or problems on a specific topic. Authors of selected short papers would be invited to write a regular paper on the same topic for future issues of the AJOR.

## Notes for Intending Authors

Submitted papers should not have been previously published nor be currently under consideration for publication elsewhere. Paper submission will be handled electronically through the website. All papers are refereed through a peer review process. For more details about the submissions, please access the website.

## Website and E-mail

<http://www.scirp.org/journal/ajor>

E-mail: [ajor@scirp.org](mailto:ajor@scirp.org)

## ***What is SCIRP?***

Scientific Research Publishing (SCIRP) is one of the largest Open Access journal publishers. It is currently publishing more than 200 open access, online, peer-reviewed journals covering a wide range of academic disciplines. SCIRP serves the worldwide academic communities and contributes to the progress and application of science with its publication.

## ***What is Open Access?***

All original research papers published by SCIRP are made freely and permanently accessible online immediately upon publication. To be able to provide open access journals, SCIRP defrays operation costs from authors and subscription charges only for its printed version. Open access publishing allows an immediate, worldwide, barrier-free, open access to the full text of research papers, which is in the best interests of the scientific community.

- High visibility for maximum global exposure with open access publishing model
- Rigorous peer review of research papers
- Prompt faster publication with less cost
- Guaranteed targeted, multidisciplinary audience



**Scientific  
Research  
Publishing**

**Website: <http://www.scirp.org>**

**Subscription: [sub@scirp.org](mailto:sub@scirp.org)**

**Advertisement: [service@scirp.org](mailto:service@scirp.org)**