学術コミュニケーションの基礎知識

杉田茂樹（京都大学附属図書館）

オープンアクセス新任担当者研修

令和2年10月9日・12日

オープンアクセスリポジトリ推進協会

自己紹介

- 大学は文学部
  （理系のまともな研究論文を見たことがない）
- 1993　北大図書館に入職（雑誌担当係）
  （届いた雑誌に日付シールを貼って書架に並べるなど）
- 2005　何回かの異動ののち、北大図書館でリポジトリ業務
  （いろいろなことがよくわからない）

本日の内容

- 学術雑誌とはどういうものか
- 論文とはどういうものか

科学的発見／知見

“Smaismrmilmepoetalevmibunenugttaviras”

altissimum planetam tergeminum observari.

“学術雑誌の４機能”

それを生み出したのが私だと世界に認知してほしい

論文の先取権の確立

査読による質の保証

その科学的真価を認めてほしい

世に広まってほしい

知見を世に知らせる

知見を後世に伝える

後世にも伝えたい

ヘンリー・オルデンバーグ氏の書簡（1664～1665）より。同氏は、世界最古の学術雑誌と言われるイギリス王立協会「フィロソフィカル・トランザクション」（1665～）創刊時の事務総長

一般的な出版物

- 著者・作者は原稿料や印税などを受け取り、収入とする

学術雑誌

むしろ著者がお金（例えば20万円とか）を払うケースもある。次講参照

- 著者は対価を得ない
  - 研究論文執筆・公開の目的は金銭でなく、著作が広く行き渡り、科学の発展に寄与すること
  - 収入は所属機関の給与など。学術的名声を得て、ポストを獲得することが間接的に収入に寄与

PROCEEDINGS OF THE ROYAL SOCIETY A

MATHEMATICAL, PHYSICAL AND ENGINEERING SCIENCES

The Royal Society's physical sciences research journal, publishing high-quality research and review articles from all disciplines in the physical sciences

Current issue

Editor-In-Chief

Professor Michael Lockwood FRS

Frequency: **Monthly**
ISSN (Online): **1471-2946**
ISSN (Print): **1364-5021**

Latest articles

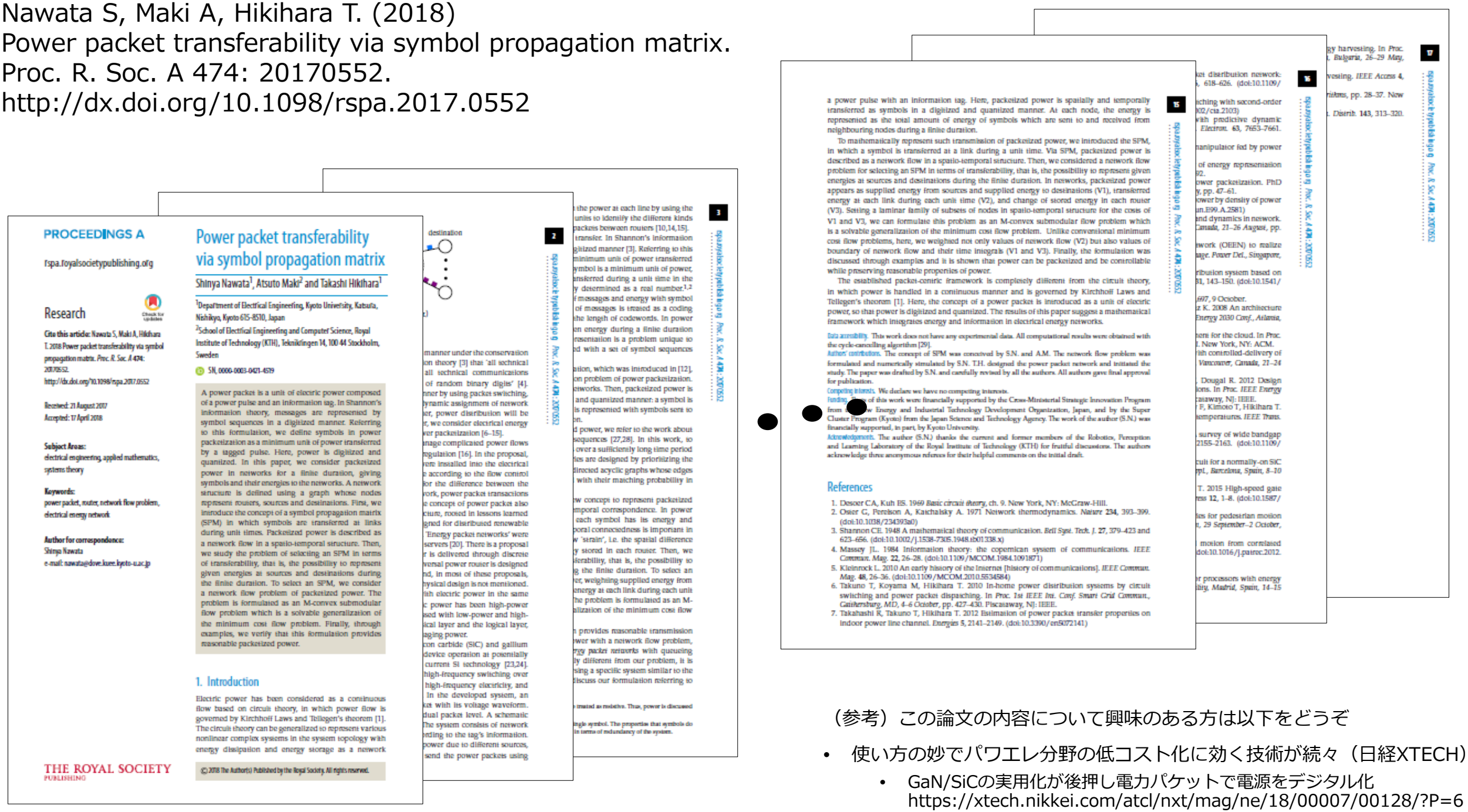
7 October 2020

7 October 2020

7 October 2020

7 October 2020

Nawata S, Maki A, Hikihara T. (2018)
Power packet transferability via symbol propagation matrix.
Proc. R. Soc. A 474: 20170552.
http://dx.doi.org/10.1098/rspa.2017.0552



PROCEEDINGS A

rspa.royalsocietypublishing.org

Research

Cite this article: Nawata S, Maki A, Hikihara T. 2018 Power packet transferability via symbol propagation matrix. *Proc. R. Soc. A* **474**: 20170552.
http://dx.doi.org/10.1098/rspa.2017.0552

Received: 21 August 2017
Accepted: 17 April 2018

Subject Areas:
electrical engineering, applied mathematics, systems theory

Keywords:
power packet, router, network flow problem, electrical energy network

Author for correspondence:
Shinya Nawata
e-mail: nawata@dove.kuee.kyoto-u.ac.jp

THE ROYAL SOCIETY PUBLISHING

Power packet transferability via symbol propagation matrix

Shinya Nawata[1], Atsuto Maki[2] and Takashi Hikihara[1]

[1]Department of Electrical Engineering, Kyoto University, Katsura, Nishikyo, Kyoto 615-8510, Japan
[2]School of Electrical Engineering and Computer Science, Royal Institute of Technology (KTH), Teknikringen 14, 100 44 Stockholm, Sweden

SN, 0000-0003-0421-4579

A power packet is a unit of electric power composed of a power pulse and an information tag. In Shannon's information theory, messages are represented by symbol sequences in a digitized manner. Referring to this formulation, we define symbols in power packetization as a minimum unit of power transferred by a tagged pulse. Here, power is digitized and quantized. In this paper, we consider packetized power in networks for a finite duration, giving symbols and their energies to the networks. A network structure is defined using a graph whose nodes represent routers, sources and destinations. First, we introduce the concept of a symbol propagation matrix (SPM) in which symbols are transferred at links during unit times. Packetized power is described as a network flow in a spatio-temporal structure. Then, we study the problem of selecting an SPM in terms of transferability, that is, the possibility to represent given energies as sources and destinations during the finite duration. To select an SPM, we consider a network flow problem of packetized power. The problem is formulated as an M-convex submodular flow problem which is a solvable generalization of the minimum cost flow problem. Finally, through examples, we verify that this formulation provides reasonable packetized power.

1. Introduction

Electric power has been considered as a continuous flow based on circuit theory, in which power flow is governed by Kirchhoff Laws and Tellegen's theorem [1]. The circuit theory can be generalized to represent various nonlinear complex systems in the system topology with energy dissipation and energy storage as a network

References

1. Desoer CA, Kuh ES. 1969 *Basic circuit theory*, ch. 9. New York, NY: McGraw-Hill.
2. Oster G, Perelson A, Kaichalsky A. 1971 Network thermodynamics. *Nature* **234**, 393–399. (doi:10.1038/234393a0)
3. Shannon CE. 1948 A mathematical theory of communication. *Bell Syst. Tech. J.* **27**, 379–423 and 623–656. (doi:10.1002/j.1538-7305.1948.tb01338.x)
4. Massey JL. 1984 Information theory: the copernican system of communications. *IEEE Commun. Mag.* **22**, 26–28. (doi:10.1109/MCOM.1984.1091871)
5. Kleinrock L. 2010 An early history of the Internet [history of communications]. *IEEE Commun. Mag.* **48**, 26–36. (doi:10.1109/MCOM.2010.5534584)
6. Takuno T, Koyama M, Hikihara T. 2010 In-home power distribution systems by circuit switching and power packet dispatching. In *Proc. 1st IEEE Int. Conf. Smart Grid Commun., Gaithersburg, MD, 4–6 October*, pp. 427–430. Piscataway, NJ: IEEE.
7. Takahashi R, Takuno T, Hikihara T. 2012 Estimation of power packet transfer properties on indoor power line channel. *Energies* **5**, 2141–2149. (doi:10.3390/en5072141)

（参考）この論文の内容について興味のある方は以下をどうぞ

- 使い方の妙でパワエレ分野の低コスト化に効く技術が続々（日経XTECH）
  - GaN/SiCの実用化が後押し電力パケットで電源をデジタル化
    https://xtech.nikkei.com/atcl/nxt/mag/ne/18/00007/00128/?P=6

PROCEEDINGS A

rspa.royalsocietypublishing.org

Research

Cite this article: Nawata S, Maki A, Hikihara T. 2018 Power packet transferability via symbol propagation matrix. *Proc. R. Soc. A* **474**: 20170552.
http://dx.doi.org/10.1098/rspa.2017.0552

Received: 21 August 2017
Accepted: 17 April 2018

Subject Areas:
electrical engineering, applied mathematics, systems theory

Keywords:
power packet, router, network flow problem, electrical energy network

Author for correspondence:
Shinya Nawata
e-mail: nawata@dove.kuee.kyoto-u.ac.jp

Power packet transferability via symbol propagation matrix

Shinya Nawata[1], Atsuto Maki[2] and Takashi Hikihara[1]

[1]Department of Electrical Engineering, Kyoto University, Katsura, Nishikyo, Kyoto 615-8510, Japan
[2]School of Electrical Engineering and Computer Science, Royal Institute of Technology (KTH), Teknikringen 14, 100 44 Stockholm, Sweden

SN, 0000-0003-0421-4519

A power packet is a unit of electric power composed of a power pulse and an information tag. In Shannon's information theory, messages are represented by symbol sequences in a digitized manner. Referring to this formulation, we define symbols in power packetization as a minimum unit of power transferred by a tagged pulse. Here, power is digitized and quantized. In this paper, we consider packetized power in networks for a finite duration, giving symbols and their energies to the networks. A network structure is defined using a graph whose nodes represent routers, sources and destinations. First, we introduce the concept of a symbol propagation matrix (SPM) in which symbols are transferred at links during unit times. Packetized power is described as a network flow in a spatio-temporal structure. Then, we study the problem of selecting an SPM in terms of transferability, that is, the possibility to represent given energies at sources and destinations during the finite duration. To select an SPM, we consider a network flow problem of packetized power. The problem is formulated as an M-convex submodular flow problem which is a solvable generalization of the minimum cost flow problem. Finally, through

雑誌の名前

この論文を表す記号「DOI」
※「JPCOAR学術コミュニケーションセミナー」プログラムD（12/7）で取り上げられます。

掲載までの経緯
2017.8.21に投稿され、査読を経て、2018.4.17に受理が決定した

照会等の窓口となる著者

PROCEEDINGS A

rspa.royalsocietypublishing.org

Research

Cite this article: Nawata S, Maki A, Hikihara T. 2018 Power packet transferability via symbol propagation matrix. *Proc. R. Soc. A* **474**:

http://dx.doi.org/10.1098/rspa.2017.0552

Received: 21 August 2017
Accepted: 17 April 2018

Subject Areas:
electrical engineering, applied mathematics, systems theory

Keywords:
power packet, router, network flow problem, electrical energy network

Author for correspondence:
Shinya Nawata
e-mail: nawata@dove.kuee.kyoto-u.ac.jp

Power packet transferability via symbol propagation matrix

Shinya Nawata[1], Atsuto Maki[2] and Takashi Hikihara[1]

[1]Department of Electrical Engineering, Kyoto University, Katsura, Nishikyo, Kyoto 615-8510, Japan
[2]School of Electrical Engineering and Computer Science, Royal Institute of Technology (KTH), Teknikringen 14, 100 44 Stockholm, Sweden

SN, 0000-0003-0421-4519

A power packet is a unit of electric power composed of a power pulse and an information tag. In Shannon's information theory, messages are represented by symbol sequences in a digitized manner. Referring to this formulation, we define symbols in power packetization as a minimum unit of power transferred by a tagged pulse. Here, power is digitized and quantized. In this paper, we consider packetized power in networks for a finite duration, giving symbols and their energies to the networks. A network structure is defined using a graph whose nodes represent routers, sources and destinations. First, we introduce the concept of a symbol propagation matrix (SPM) in which symbols are transferred at links during unit times. Packetized power is described as a network flow in a spatio-temporal structure. Then, we study the problem of selecting an SPM in terms of transferability, that is, the possibility to represent given energies at sources and destinations during the finite duration. To select an SPM, we consider a network flow problem of packetized power. The problem is formulated as an M-convex submodular flow problem which is a solvable generalization of the minimum cost flow problem. Finally, through

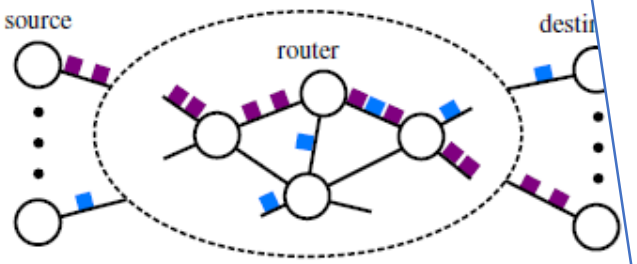
この論文の題名

この論文の著者
自然科学分野では複数名の共著であることが多い

著者の所属
この例では1に所属する著者が2名、2が1名

著者を表す記号「ORCID」
この例は筆頭著者の縄田信哉先生のもの
※「JPCOAR学術コミュニケーションセミナー」プログラムD（12/7）で取り上げられます。

引用する文献の提示



gure 1. A schematic of power packet dispatching network. (Online version in colour.)

ermodynamics [2]. Here, energy flow is handled in a continuous manner under the conservation energy. On the other hand, it is shown in Shannon's information theory [3] that 'all technical ommunications are essentially digital; more precisely, that all technical communications e equivalent to the generation, transmission and reception, of random binary digits' [4]. ommunication networks have been developed in a digitized manner by using packet switching, hich breaks messages into smaller pieces named 'packets', for dynamic assignment of network sources [5]. If we handle electric power in a digitized manner, power distribution will be anged completely different from the conventional. In this paper, we consider electrical energy etworks in which power is digitized and quantized through power packetization [6–15].

The con
power
ectric e
ergy n
ata tran
eneratio
ere pro
ppeared
om the
ergy, p
so prop
r a con
ower lev
nd evaluated

- 科学の発展＝先人の業績を踏まえ、新たな知見を積み足す
  - 参考とした先行研究に対しては引用という形で礼を尽くす
  - 多く引用された研究論文は、後続研究に大きな影響を与えたものと評価される

（参考）掲載した論文が多く引用されると、その雑誌自体の評価が上がる
（それを数値化したものとして「インパクトファクター」がある）

The established packet-centric framework is completely different from the circuit theory, in which power is handled in a continuous manner and is governed by Kirchhoff Laws and Tellegen's theorem [1]. Here, the concept of a power packet is introduced as a unit of electric power, so that power is digitized and quantized. The results of this paper suggest a mathematical framework which integrates energy and information in electrical energy networks.

Data accessibility. This work does not have any experimental data. All computational results were obtained with the cycle-cancelling algorithm [29].

Authors' contributions. The concept of SPM was conceived by S.N. and A.M. The network flow problem was formulated and numerically simulated by S.N. T.H. designed the power packet network and initiated the study. The paper was drafted by S.N. and carefully revised by all the authors. All authors gave final approval for publication.

Competing interests. We declare we have no competing interests.

Funding. Parts of this work were financially supported by the Cross-Ministerial Strategic Innovation Program from the New Energy and Industrial Technology Development Organization, Japan, and by the Super Cluster Program (Kyoto) from the Japan Science and Technology Agency. The work of the author (S.N.) was financially supported, in part, by Kyoto University.

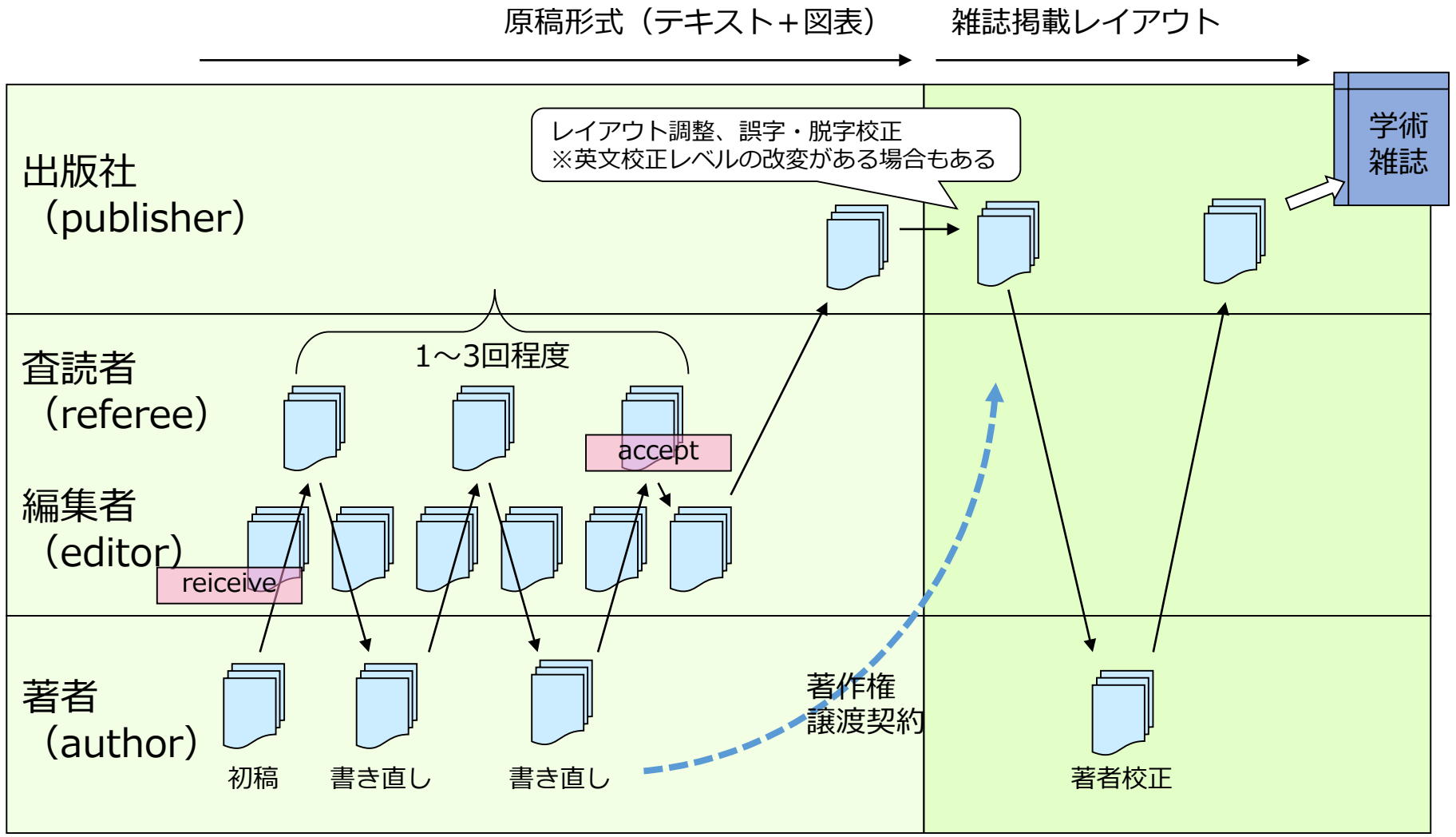
Acknowledgements. The author (S.N.) thanks the current and former members of the Robotics, Perception and Learning Laboratory of the Royal Institute of Technology (KTH) for fruitful discussions. The authors acknowledge three anonymous referees for their helpful comments on the initial draft.

References

1. Desoer CA, Kuh ES. 1969 *Basic circuit theory*, ch. 9. New York, NY: McGraw-Hill.
2. Oster G, Perelson A, Katchalsky A. 1971 Network thermodynamics. *Nature* **234**, 393–399. (doi:10.1038/234393a0)
3. Shannon CE. 1948 A mathematical theory of communication. *Bell Syst. Tech. J.* **27**, 379–423 and 623–656. (doi:10.1002/j.1538-7305.1948.tb01338.x)
4. Massey JL. 1984 Information theory: the copernican system of ommunications. *IEEE Commun. Mag.* **22**, 26–28. (doi:10.1109/MCOM.1984.1091871)
n early history of the Internet [history of commu tions]. *IEEE Commun.* 10.1109/MCOM.2010.5534584)
M, Hikihara T. 2010 In-home power distri n systems by circuit r packet dispatching. In *Proc. 1st IEEE Int. Smart Grid Commun.*, *6 October*, pp. 427–430. Piscataway, NJ: IEEE.
T, Hikihara T. 2012 Estimation of power nsfer properties on annel. *Energies* **5**, 2141–

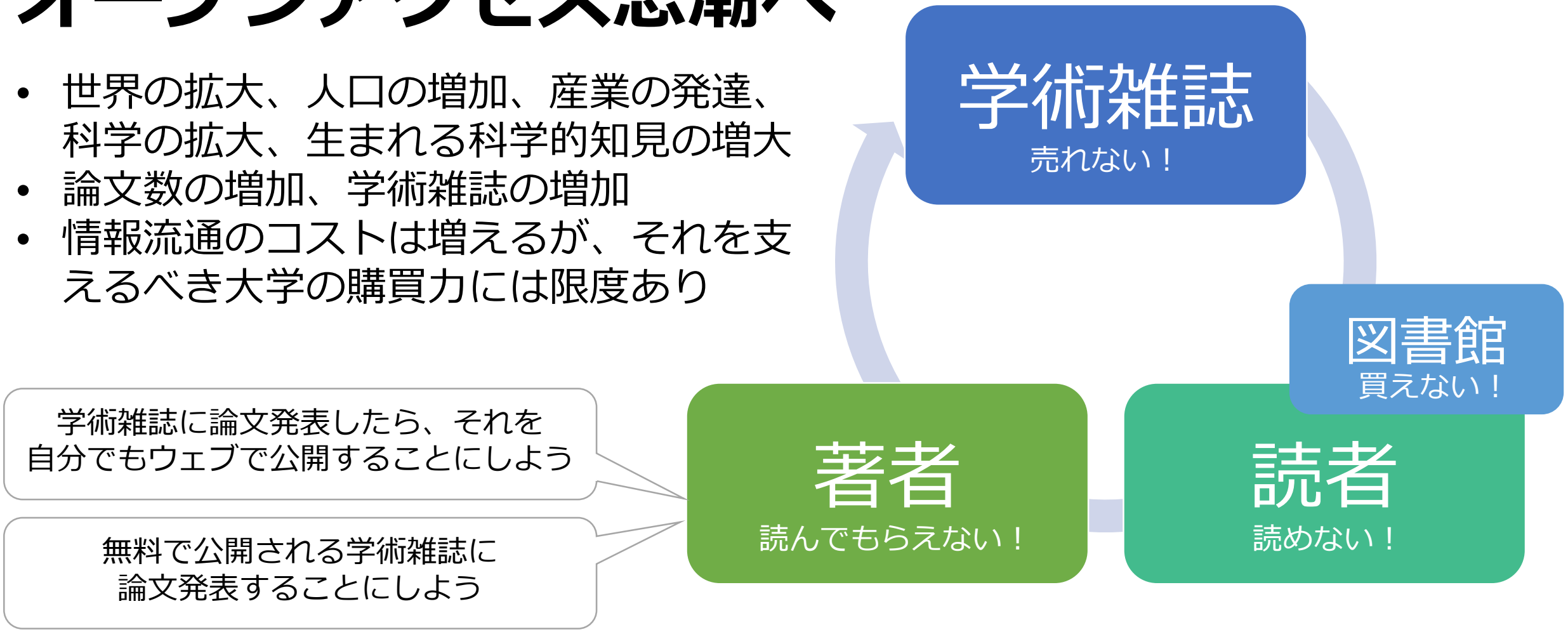
引用された文献

論文が学術雑誌に掲載されるまで



学術情報の流通不全から オープンアクセス思潮へ

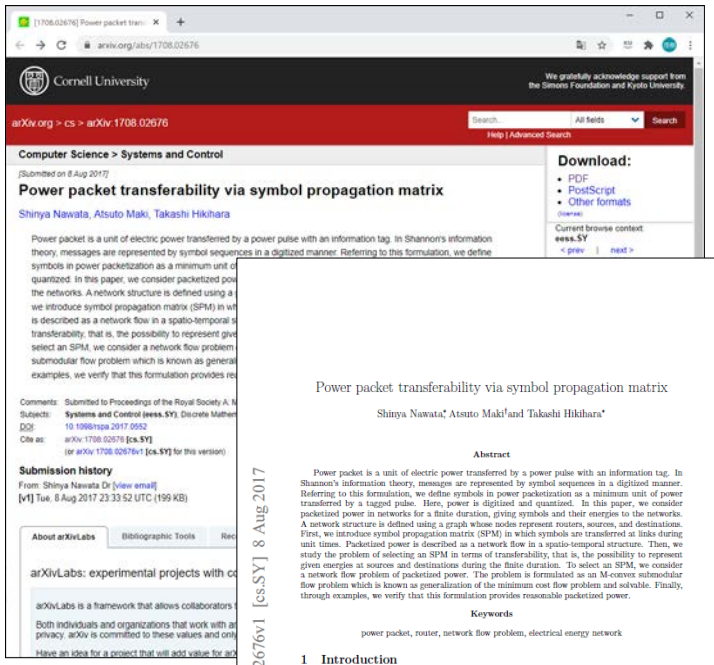
- 世界の拡大、人口の増加、産業の発達、科学の拡大、生まれる科学的知見の増大
- 論文数の増加、学術雑誌の増加
- 情報流通のコストは増えるが、それを支えるべき大学の購買力には限度あり

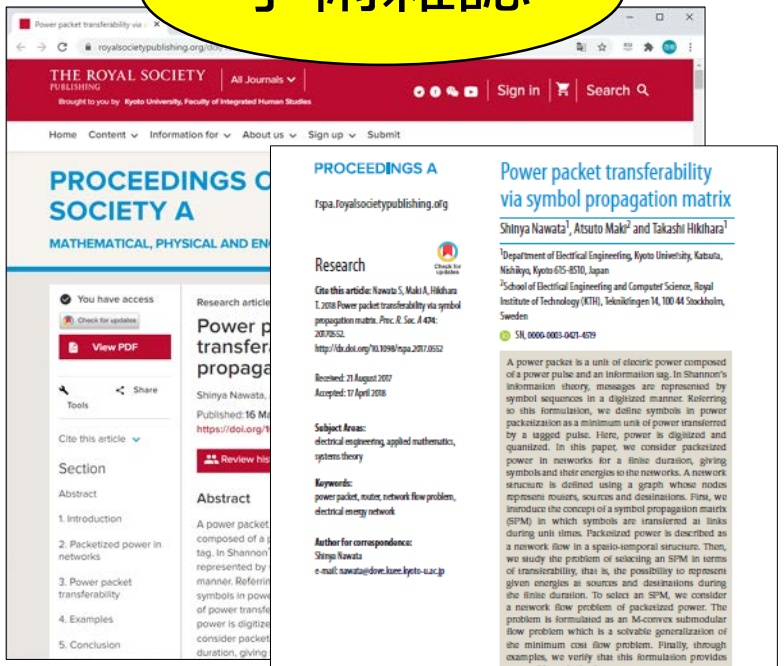


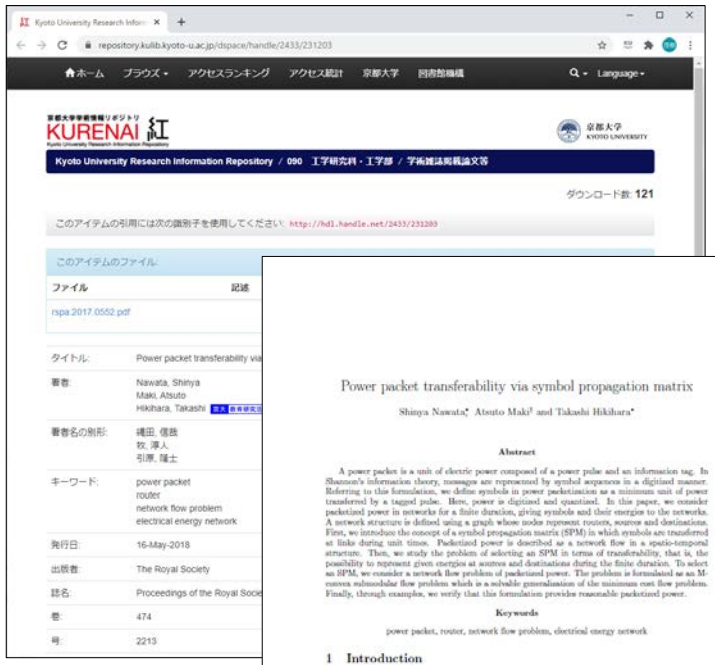
プレプリントサーバ
（誰でも読める）

学術雑誌

機関リポジトリ
（誰でも読める）







学術雑誌に発表する論文
を自分でもウェブで公開

これが正式版。しかし有料の
ため読めない人もいる

学術雑誌に発表した論文
を自分でもウェブ公開

Nawata S, Maki A, Hikihara T. (2018)
Power packet transferability via symbol propagation matrix.

※著作を広く行き渡らせるための別法として、無料公開される学術雑誌で発表するという手もある　→「ゴールドオープンアクセスの動向」
※研究論文のみならず、その源泉となった実験データ・観測データ等の取扱いや流通にも関心が集まっている　→「研究データの管理と公開」