

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

それを生み出したのが私だと世界に認知してほしい

その科学的真価を認めてほしい

世に広まってほしい

後世にも伝えたい

*“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

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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

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- 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

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Power packet transferability via symbol propagation matrix
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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 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



the power at each line by using the units to identify the different kinds of packets between routers [10,14,15]. transfer. In Shannon's information digitized manner [3]. Referring to this minimum unit of power transferred symbol is a minimum unit of power, transferred during a unit time in the y determined as a real number.^{1,2} f messages is treated as a coding the length of codewords. In power an energy during a finite duration resentation is a problem unique to ed with a set of symbol sequences

ation, which was introduced in [12], on problem of power packetization. networks. Then, packetized power is and quantized manner: a symbol is is represented with symbols sent to on.

d power, we refer to the work about sequences [27,28]. In this work, so over a sufficiently long time period ies are designed by prioritizing the directed acyclic graphs whose edges with their matching probability in

ew concepts to represent packetized mporal correspondence. In power each symbol has its energy and ocal connectedness is important in w 'strain', i.e. the spatial difference y stored in each router. Then, we ferability, that is, the possibility to g, the finite duration. To select an er, weighting supplied energy from energy at each link during each unit the problem is formulated as an M-alization of the minimum cost flow

n provides reasonable transmission iver with a network flow problem, ggy packet networks with queuing y different from our problem, it is sing a specific system similar to the discuss our formulation referring to

trained as routers. Thus, power is discussed

high symbol. The proposition that symbols do its terms of redundancy of the system.

a power pulse with an information tag. Here, packetized power is spatially and temporally transferred as symbols in a digitized and quantized manner. At each node, the energy is represented as the total amount of energy of symbols which are sent to and received from neighbouring nodes during a finite duration.

To mathematically represent such transmission of packetized power, we introduced the SPM, in which a symbol is transferred at a link during a unit time. Via SPM, packetized power is described as a network flow in a spatio-temporal structure. Then, we considered a network flow problem for selecting an SPM in terms of transferability, that is, the possibility to represent given energies at sources and destinations during the finite duration. In networks, packetized power appears as supplied energy from sources and supplied energy to destinations (V1), transferred energy at each link during each unit time (V2), and change of stored energy in each router (V3). Setting a laminar family of subsets of nodes in spatio-temporal structure for the cases of V1 and V3, we can formulate this problem as an M-convex submodular flow problem which is a solvable generalization of the minimum cost flow problem. Unlike conventional minimum cost flow problems, here, we weighed not only values of network flow (V2) but also values of boundary of network flow and their time integrals (V1 and V3). Finally, the formulation was discussed through examples and it is shown that power can be packetized and be controllable while preserving reasonable properties of power.

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].

Author contributions. The concept of SPM was conceived by S.N. and A.M. The network flow problem was formulated and numerically studied 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.

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Power packet transferability via symbol propagation matrix

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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

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Power packet transferability via symbol propagation matrix

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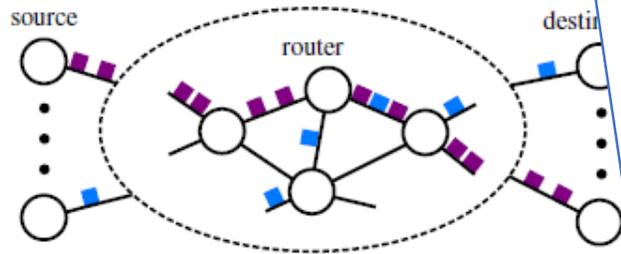


Figure 1. A schematic of power packet dispatching network. (Online version in colour.)

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

The conventional power distribution systems are based on 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.

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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.

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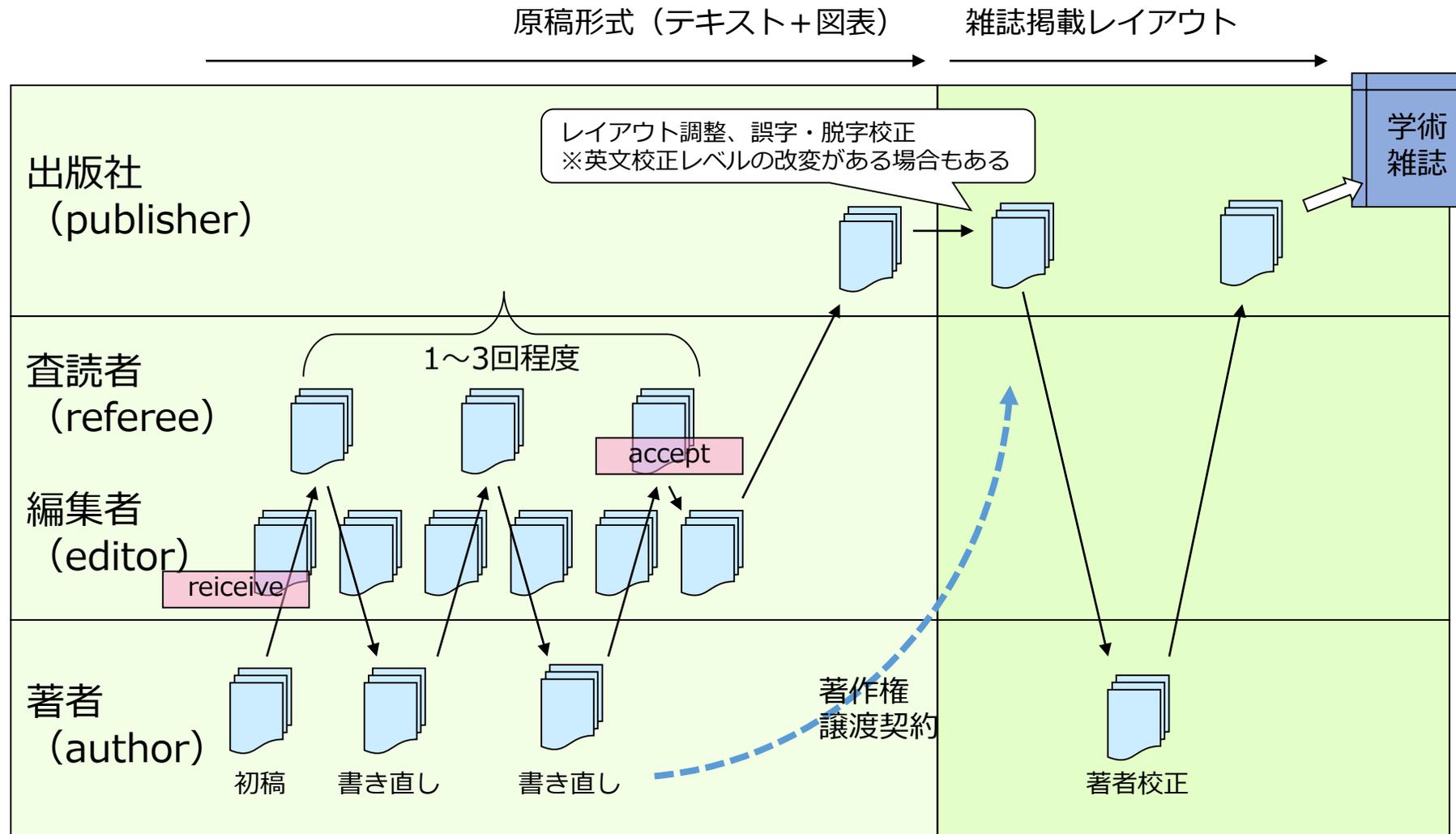
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Shinya Nawata*, Atsuto Maki[†] and Takashi Hikihara*

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Keywords

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

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 network thermodynamics [2]. Here, energy flow is handled in a continuous manner under the conservation of energy. On the other hand, it is shown in Shannon's information theory [3] that "all technical communications are essentially digital; more precisely, that all technical communications are equivalent to the generation, transmission, and reception, of random binary digits" [4]. Communication networks have been developed in a digitized manner by utilizing packet switching, which breaks messages into smaller pieces named "packets", for dynamic assignment of network resources [5]. If we handle electric power in a digitized manner, power distribution will be changed completely different from the continuous power flows in power grids, electrical energy networks. The

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