Environmental Engineering Division of JSME

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TOPICS

ABSTRACTS, FIGURES(inc.Japanese words) and CAPTIONS

[2021-1]

Prediction of structure-borne sound transmission characteristics via building structure by using Finite-difference time-domain method

Takumi Asakura, Tokyo University of Science

ABSTRACT [2020-2]

In order to accurately predict the vibration characteristics of buildings, wave-based numerical methods are effective from the viewpoint of the modeling accuracy of the physical mechanism and the detailed geometries of the simulated field. However, because of the performance of current PCs, the prediction of real-scale problems remains difficult. In order to address such problems, we herein propose a vibration simulation method for a beam-plate structure using a dimension-reduced modeling method. The target structure is modeled as a composite structure consisting of two-dimensional plate elements and one-dimensional beam elements, which are coupled based on the implicit finite-difference approximation scheme. By applying such a low-dimensional element, a faster simulation that requires less memory, as compared with a three-dimensional discretization scheme, is made available. To validate the method, the vibration characteristics obtained by the proposed scheme are compared to the measured results for full-scale structure. The comparison of the measurement and simulation results suggest that the proposed method can be used to accurately simulate a multilayered building structure.

FIGURES (inc.Japanese words) and CAPTIONS [2020-2]

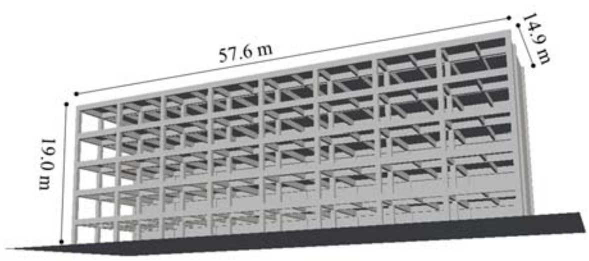

Fig. 1Simulated five-layered building structure.

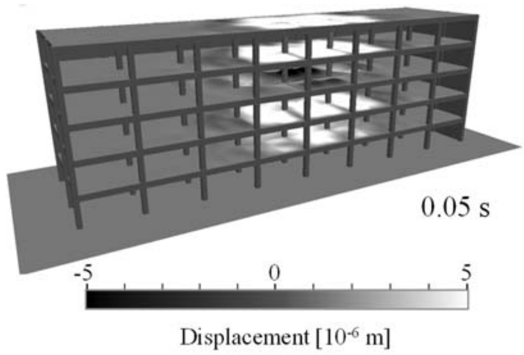

Fig. 2 Distribution of displacements of each part of the building structure simulated by FDTD method.

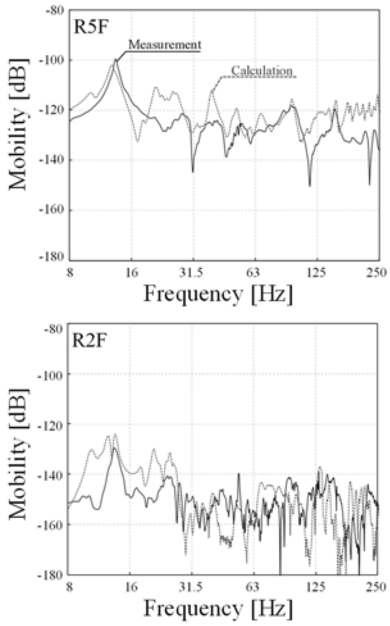

Fig. 3 Comparison of simulated and measured mobility.

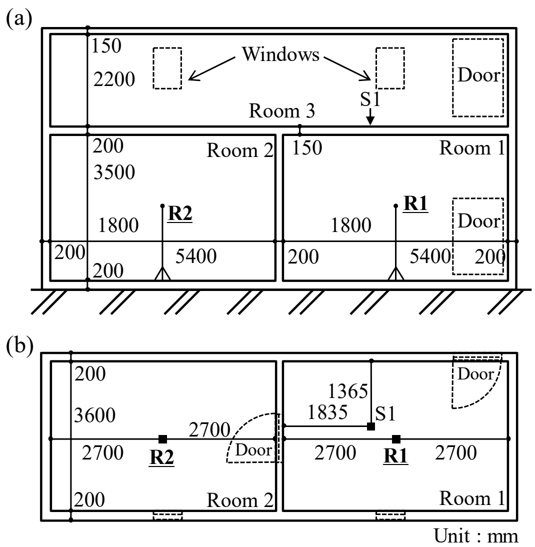

Fig. 4 Simulated two-layered concrete structure.

[2021-2]

“Advanced sustainable city” the possibility of a district energy independence city with bioenergy

Tamio IDA, Kindai University, Bio-coke Research Institute

ABSTRACT [2020-2]

The global environment is undergoing a major transformation, and natural disasters caused by irregular weather have triggered a reconsideration of the energy basement infrastructure. Based on the local city's district energy independence, we need to consider the crucial combination of renewable energy as primary energy in the near future. A local city has resources for local energy independence, including woody biomass, food waste, sludge, et al. A sludge resource is the fairest resource based on the concept of neutral technology development. Considering human beings as one of the drivers in nature, humankind has been incorporated into the universal food production → energy extraction → excrement → food production mechanism. This article describes the possibility of being technology-neutral and a future energy resource from this point of view. Primarily, it suggests that the energy resource utilization of sludge biocoke may have attractive expectations for its fundamental characteristics and that district energy independence can be realized.

FIGURES (inc.Japanese words) and CAPTIONS [2020-2]

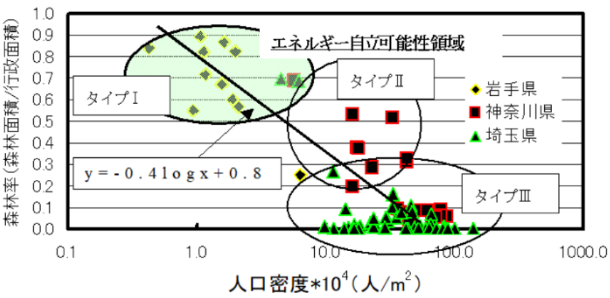

Fig.1 Condition of district energy independence by population density vs. forest rate.

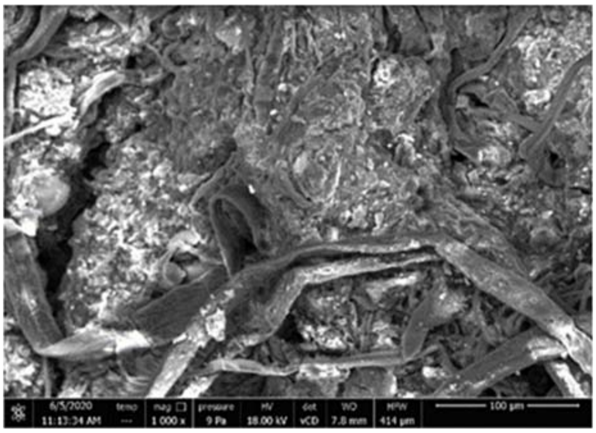

Fig.2 SEM image of law sludge(x1000).

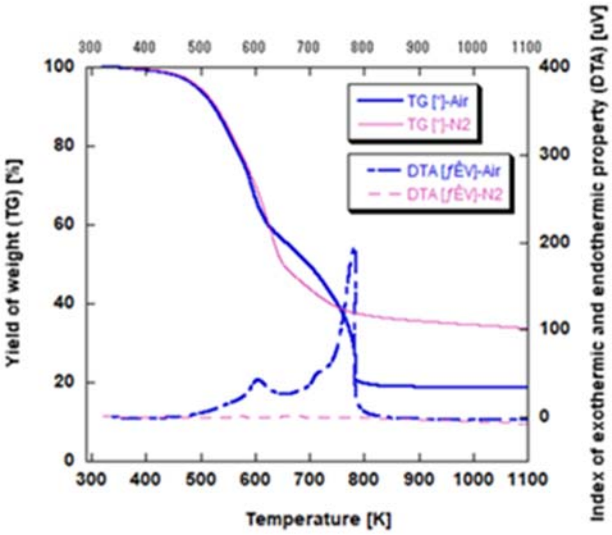

Fig.3 Thermal decomposition property of law sludge.

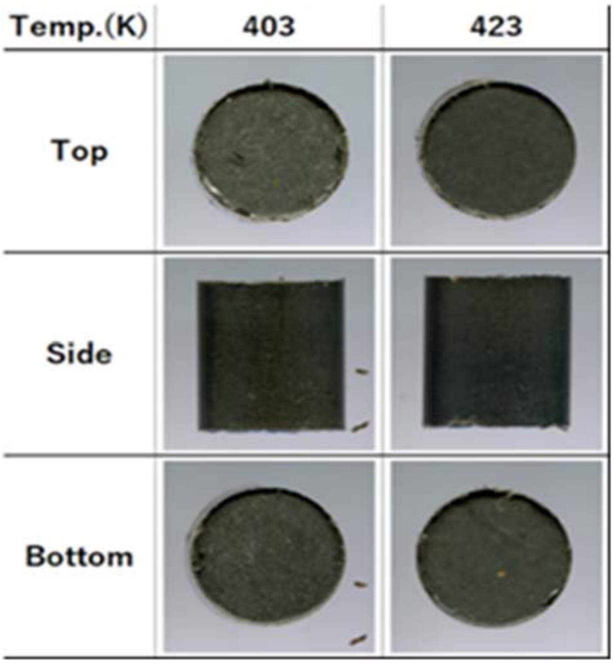

Fig.4 Sludge biocoke.

[2021-3]

Utilization of coal/biomass gasification and trends in the basic research

Yukihiko OKUMURA, Kagawa University

ABSTRACT [2020-3]

To decrease CO2 accumulation in air to alleviate global warming, efficient utilization of energy and effective utilization of renewable biomass resources are required. Coal has received attention as a suitable fossil fuel energy source because of its evenly distributed rich deposits. However, CO2 emission from burning coal is extremely high (1800–2410 g/kg). Novel methods that decrease environmental loading are therefore highly sought-after. In this context, the following three methods is currently under survey: (1) establishment of a method for the advanced use in recovered CO2, (2) integrated coal gasification combined cycles (IGCC; Fig.1) and integrated coal gasification fuel cell combined cycle (IGFC) by which a power plant can be operated at high efficiency; and (3) utilization of the gasification technologies for coal/biomass. This manuscript introduces the forefront of these three surveys and explicates fundamental phenomena of gasification/combustion by reviewing the recent published articles (2016-2020: see Table 1 and references i)-xiii)). More information is available in the Japanese scientific topic.

FIGURES (inc.Japanese words) and CAPTIONS [2020-3]

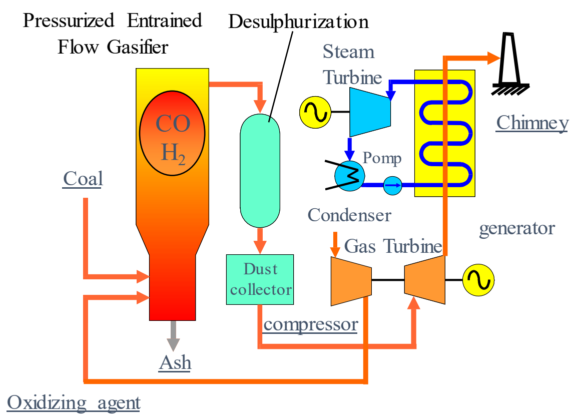

Fig. 1 Integrated Coal Gasification Combined Cycle (IGCC)

Table 1 Trends in the number of papers published in a year related to gasification

Keywords for Search	2016	2017	2018	2019	2020
Coal + Gasification	583	585	604	548	676
Biomass + Gasification	649	664	706	799	908
Waste + Gasification	336	356	378	448	560

i) M.Rabaçal et al., ***Proc. Comb. Inst***. 2019, **37,** 3005–3012.
ii) S. Farazi, et al., ***Proc. Comb. Inst***. 2019, **37,** 2867–2874.
iii) X. Wen et al., ***Proc. Comb. Inst***. 2019, **37**, 2901-2910.
iv) J. Hayashi et al., ***Proc. Comb. Inst***. 2019, **37**, 3045-3052.
v) A. Anca-Couce et al., ***Fuel*** 2017, **206**, pp. 572–579.
vi) Y. Okumura, ***J. Therm. Sci. Tech.*** 2020, **15**-3, 9 pages.
vii) Y. Ueki et al., ***J. Chem. Eng. JPN*** 2016, 49-3, 287-293.
viii) X. Chen et al., ***Proc. Comb. Inst***. 2019, **37**, 2749-2755.
ix) H. Watanabe et al., ***Energy Fuels*** 2018, **32**, 4248-4254.
x) E. Trudel et al., ***Comb. Flame*** 2018, **198**, 100-111.
xi) Q. Hu et al., ***Chem. Eng. J.*** 2020, **379**, 122346 (9pages).
xii) D. Schweitzer et al., ***Bio. Bioenergy*** 2018, **111**, 308-319.
xiii) Z. Haibo, W. Jinxing, ***Comb. Flame*** 2018, **191**, 9-18.

[2021-4]

Development Trends of Solid Oxide Fuel Cells for Commercial Use

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ABSTRACT [2020-4]

Solid oxide fuel cells (hereinafter referred to as SOFCs) are being introduced into the market not only for residential use but also for commercial and industrial use because of their high power generation efficiency.
The Hydrogen and Fuel Cell Strategy Council, sponsored by the Ministry of Economy, Trade and Industry , formulated the "Hydrogen and Fuel Cell Strategy Roadmap" in June 2014, and set the target for the commercial fuel cell market launch as 2017.In order to realize this roadmap, manufacturers have been accelerating development and the New Energy and Industrial Technology Development Organization has been promoting projects such as technological development and demonstration evaluation of fuel cells. As a result of these efforts, three companies began selling SOFCs in 2017.
The status of development and commercialization of SOFCs for commercial use is shown in Table 1. Figure 1 shows the efficiency of SOFCs that have been commercialized or are under development.

FIGURES (inc.Japanese words) and CAPTIONS [2020-4]

Table 1　The status of development and commercialization of SOFCs for commercial use

	2017年商品化			開発・実証中				商用機
メーカー	京セラ	三浦工業	三菱パワー	デンソー	日立造船	富士電機	東京ガス・三浦工業	Bloom Energy
外観								
出力　kW	3	4.2	250	5	20	50	5	200
タイプ	コージェネ	コージェネ	コージェネ	モノジェネ	コージェネ 検討中	コージェネ 検討中	モノジェネ	モノジェネ
効率%[LHV] (発電/熱回収)	52/38	50/40	55/18	50	55/(検討中)	55/30	65	初期：62 平均：52
主要想定 需要家	小規模店舗 集合住宅 ホテル 理美容院 福祉施設等	小規模店舗 集合住宅 ホテル 理美容院 福祉施設等	データセンター 大規模ビル・ホテル等	飲食店 理美容院 小規模医療 福祉施設等	中小スーパー等	病院 介護施設 食品スーパー等	小規模事務所 小規模店舗等	データセンター 大規模ビル・ホテル等
市場投入時期	2017年度	2017年度 2019年度	2017年度	検討中	検討中	検討中	2020年代前半	投入済

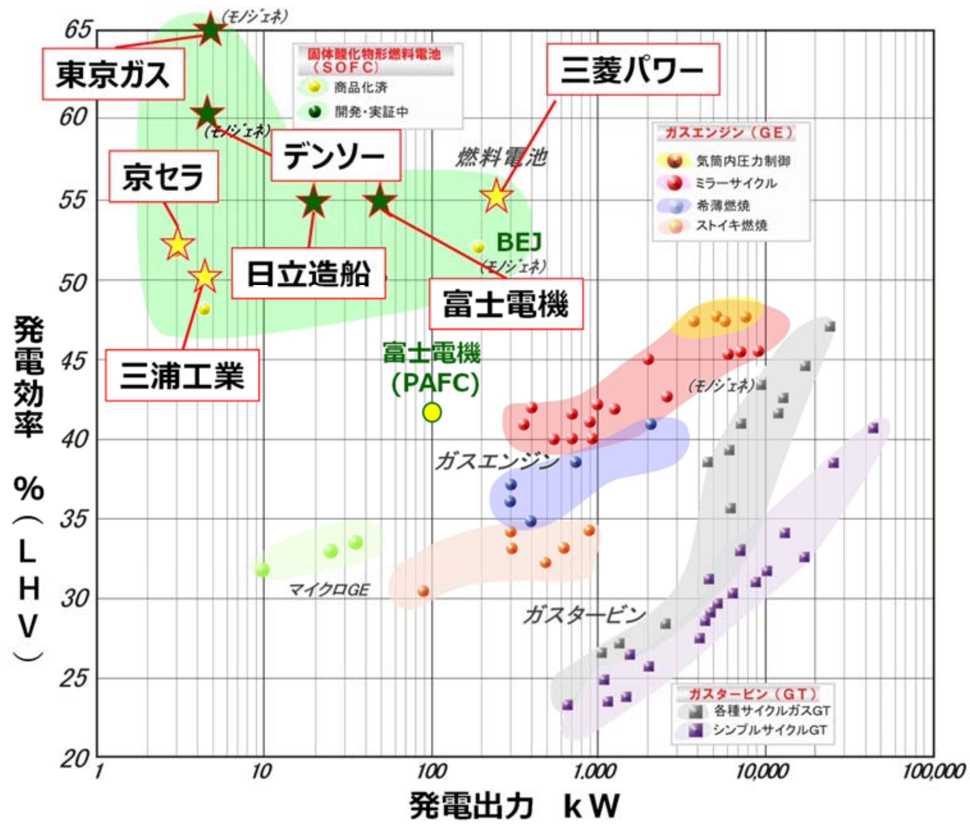

Fig. 1 The efficiency of SOFCs for commercial use