CHANGHYUP PARK

PROFESSOR

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KANGWON NATIONAL UNIVERSITY | CHUNCHEON | KANGWON | SOUTH KOREA

Education

PH. Doctor (Feb. 2005)
SEOUL NATIONAL UNIVERSITY
Division of Civil, Urban, and Geosystems Engineering
  Ph.D Dissertation: A new streamline analysis for solute transport in 3D discrete fractured media by automatic quadrilateral meshing

Master of Science (Feb. 2000)
SEOUL NATIONAL UNIVERSITY
Depart. of Petroleum and Mineral Resources Engineering.
  MS Thesis: Pressure transient analysis of random fracture networks with fractal geometry

Bachelor of Science (Feb. 1998)
SEOUL NATIONAL UNIVERSITY
Depart. of Petroleum and Mineral Resources Engineering.

Research Interest

RESERVOIR SIMULATION
FRACTURED RESERVOIR
DATA ANALYTICS

UNCONVENTIONAL RESOURCES
GAS HYDRATE | SHALE GAS

ECONOMIC EVALUATION
CONTRACT | REAL OPTIONS

DEEP LEARNING
HISTORY MATCHING | OPTIMIZATION

Teaching Experience

Professor (Sep. 2010 – Present)
KANGWON NATIONAL UNIVERSITY
Depart. of Energy and Resources Engineering
Convergence Program of Carbon Neutral Industry
Depart. of Integrative Engineering for Hydrogen Safety
  - Introduction to Reservoir Engineering
  - Hands-on Deep Learning
  - Drilling Engineering and Production System
  - AI-based System Optimization
  - Numerical Analysis for Engineers
  - Energy and Climate Change Policy

Distinguished Lecturer
SEOUL NATIONAL UNIVERSITY
Petroleum Academy (May 2007 – May 2017)

KOREA NATIONAL OIL CORPORATION
KNOC Petroleum Academy (2012 – 2016)

Part-time Instructor
SEJONG UNIVERSITY (Aug. – Dec. 2008)
CHONNAM NATIONAL UNIVERSITY
(Sep. 2008 – Feb. 2010)

Research Experience

Visiting Professor (Feb. 2018 – Feb. 2019)
UNIVERSITY OF TEXAS AT AUSTIN
Center for Petroleum & Geosystems Engineering

Visiting Assistant Professor (Mar. – Aug. 2010)
STANFORD UNIVERSITY

BK21 Assistant Professor (Dec. 2008 – Mar. 2010)
SEOUL NATIONAL UNIVERSITY

Postdoctoral Fellow
(Aug. – Dec. 2006; Sep. – Nov. 2008)
SEOUL NATIONAL UNIVERSITY

Researcher (Mar. 2005 – Aug. 2006)
SEOUL NATIONAL UNIVERSITY
Research Institute for Energy Resources

Technical Assistant (Jan. 1999 – Feb. 2002)
SEOUL NATIONAL UNIVERSITY
Research Institute for Energy Resources

CHANGHYUP PARK

Industrial Experience

Reservoir Engineer   (Jan. 2007 – Sep. 2008)
STX ENERGY CO.
- Technical evaluation of E&P projects
- Contract farm-in agreement with Shell
- Delegate at TCM and OCM

Softwares and Books

Registered Softwares
SNUFRACS (No. 2003-01-12-2121)
- Kang, J.M., Jang, I., Park, H.J., Park, C., and Roh, J.
DATAFRAC (No. 2003-01-11-2120)
- Kang, J.M., Jang, I., Park, H.J., Park, C., and Noh, J.
- Development Tool : C++ builder, OpenGL

Book
Unnconventional Resources Development (Nov. 2015)
- Shin, H., Lee, K., Lee, D., Jang, I., and Park, C.

Professional Activity

Editorial Board Member
Journal of Petroleum Exploration and Production Technology   (Jan. 2022–Present)
International Journal of Oil, Gas, and Coal Technology   (June 2019 – Present)
Journal of the Korean Society of Mineral & Energy Resources Engineers   (Jan. 2022–Dec. 2023)
Sustainability(Guest editor) (July 2020 – Feb. 2021)
Geosystem Engineering   (Jan. 2016 – Dec. 2017)
Journal of Energy Engineering
                         (Jan. 2009 – Dec. 2010)

Society of Petroleum Engineers
Professional Memeber   (2009 – Present)
KOREA SECTION
Liaison YP and Internet Chairperson
                         (Jan. 2008 – Aug. 2010)
YP Chair (Liaison YP)   (Sep. 2010 – Dec. 2020)

Lifetime Member
International Association for Mathematical Geosciences   (Nov. 2020)
Korean Society of Petroleum Engineers (Oct. 2020)
Korean Society for Mineral and Energy Resources
                         (Aug. 2011)
Korean Society for Rock Mechanics
                         (May 2012)

Regular Member
AGU (American Geophysical Union)
EAGE (European Association of Geoscientists & Engineers)
KSEG (Korean Society of Earth and Exploration Geophysicists)

Awards and Honors

**Regional Distinguished Achievement Award for Petroleum Engineering Faculty
(Northern Asia Pacific Region)**
SOCIETY OF PETROLEUM ENGINEERS   (Oct. 2020)

Distinguished Professor Award
KANGWON NATIONAL UNIVERSITY   (Dec. 2017)

Distinguished Engineering Faculty Award
College of Engineering
KANGWON NATIONAL UNIVERSITY   (Dec. 2017)

Best Paper Presentation Award
THE KOREAN SOCIETY OF ENERGY ENGINEERING
                         (May 2005)

Scholarship
All Expense Scholarship
                    (Asan Foundation ; 1995 – 1997)
SNU Scholarship

                    (1994 – 2001; 6 Semesters)

INTERNATIONAL JOURNALS

[49] Lee, S., Bae, W., Permadi, A.K., and Park, C. 2023. Hydraulic stimulation of enhanced geothermal system: A case study at Patuha geothermal field, Indonesia. *International Journal of Energy Research* 2023: 9220337. https://doi.org/10.1155/2023/9220337

[48] Jo, S., Ahn, S., Park, C., and Kim, J. 2022. Generative geomodeling based on flow responses in latent space. *Journal of Petroleum Science and Engineering* 211: 110177. https://doi.org/10.1016/j.petrol.2022.110177

[47] Caesary, D., Kim, J., Jang, S.J., Quach, N., Park, C., Kim, H.M., and Nam, M.J. 2022. Numerical modeling and evaluation of lab-scale CO_2-injection experiments based on electrical resistivity measurements. *Journal of Petroleum Science and Engineering* 208(E): 109788. https://doi.org/10.1016/j.petrol.2021.109788

[46] Jo, S., Jeong, H., Min, B., Park, C., Kim, Y., Kwon, S., and Sun, A. 2022. Efficient deep-learning-based history matching for fluvial channel reservoirs. *Journal of Petroleum Science and Engineering* 208(E): 109247. https://doi.org/10.1016/j.petrol.2021.109247

[45] Kim, J., Park, C., Ahn, S., Kang, B., Jung, H., and Jang, I. 2021. Iterative learning-based many-objective history matching using deep neural network with stacked autoencoder. *Petroleum Science* 18(5): 1465–1482. https://doi.org/10.1016/j.petsci.2021.08.001

[44] Park, C., Oh, J., Jo, S., Jang, I., and Lee, K.S. 2021. Multi-objective optimization of CO_2 sequestration in heterogeneous saline aquifers under geological uncertainty. *Applied Sciences* 11(20): 9759. https://doi.org/10.3390/app11209759

[43] Ahn, T., Lee, J., Lee, J.Y., Kim, S., and Park, C. 2021. Experimental analysis on the depressurization-induced gas production from 10-meter-scale hydrate-bearing sediments. *International Journal of Offshore and Polar Engineering* 31(3): 372–377. https://doi.org/10.17736/ijope.2021.jc815

[42] Jo, S., Park, C., Ryu, D.W., and Ahn, S. 2021. Adaptive surrogate estimation with spatial features using a deep convolutional autoencoder for CO_2 geological sequestration. *Energies* 14(2): 413. https://doi.org/10.3390/en14020413

[41] Riswati, S.S., Bae, W., Park, C., Permadi, A.K., and Novriansyah, A. 2020. Nonionic surfactant to enhance the performances of alkaline-surfactant-polymer flooding with a low salinity constraint. *Applied Sciences* 10(11): 3752. https://doi.org/10.3390/app10113752

[40] Kim, J., Kim, S., Park, C., and Lee, K. 2020. Construction of prior models for ES-MDA by a deep neural network with a stacked autoencoder for predicting reservoir production. *Journal of Petroleum Science and Engineering* 187: 106800. https://doi.org/10.1016/j.petrol.2019.106800

[39] Lim, S., Park, C., Kim, J., and Jang, I. 2020. Integrated data assimilation and distance-based model selection with ensemble Kalman filter for characterization of uncertain geological scenarios. *Natural Resources Research* 29: 1063–1085. https://doi.org/10.1007/s11053-019-09489-2

[38] Novriansyah, A., Bae, W., Park, C., Permadi, A.K., and Riswati, S.S. 2020. Ketone solvent to reduce the minimum miscibility pressure for CO_2 flooding at the South Sumatra basin, Indonesia. *Processes* 8(3): 360. https://doi.org/10.3390/pr8030360

[37] Novriansyah, A., Bae, W., Park, C., Permadi, A.K., and Riswati, S.S. 2020. Optimal design of alkaline-surfactant-polymer flooding under low salinity environment. *Polymers* 12(3): 626. https://doi.org/10.3390/polym12030626

[36] Seong, Y., Park, C., Choi, J., and Jang, I. 2020. Surrogate model with a deep neural network to evaluate gas-liquid flow in a horizontal pipe. *Energies* 13(4): 968. https://doi.org/10.3390/en13040968

[35] Kim, J., Park, C., Lee, K., Ahn, S., and Jang, I. 2020. Deep neural network coupled with distance-based model selection for efficient history matching. *Journal of Petroleum Science and Engineering* 185: 106658.

https://doi.org/10.1016/j.petrol.2019.106658

[34] Chung, S., Kang, J.M., Park, C., Min, B., and Jang, I. 2019. Optimisation of steam and gas push to prevent water influx from a top-water-bearing area into a vapour chamber. *International Journal of Oil, Gas, and Coal Technology* 20(3): 304–326. https://doi.org/10.1504/IJOGCT.2019.098460

[33] Riswati, S.S., Bae, W., Park, C., Permadi, A.K., Efriza, I., and Min, B. 2019. Experimental analysis to design optimum phase type and salinity gradient of Alkaline Surfactant Polymer flooding at low saline reservoir. *Journal of Petroleum Science and Engineering* 173: 1005–1019. https://doi.org/10.1016/j.petrol.2018.09.087

[32] Ahn, S., Park, C., Kim, J., and Kang, J.M. 2018. Data-driven inverse modeling with a pre-trained neural network at heterogeneous channel reservoirs. *Journal of Petroleum Science and Engineering* 170: 785–796. https://doi.org/10.1016/j.petrol.2018.06.084

[31] Choi, J., Park, C., and Jeong, S. 2018. Optimization of Fast-steam-assisted gravity drainage for the energy-efficient operations at a heterogeneous oil-sands reservoir. *Energy Exploration and Exploitation* 36(5): 1040–1060. https://doi.org/10.1177/0144598717749355

[30] Jang, I., Oh, S., Kim, Y., Park, C., and Kang, H. 2018. Well-placement optimisation using sequential artificial neural networks. *Energy Exploration and Exploitation* 36(3): 433–449. https://doi.org/10.1177/0144598717729490

[29] Jung, S., Lee, K., Park, C., and Choe, J. 2018. Ensemble-based data assimilation in reservoir characterization: A review. *Energies* 11(2): 445. https://doi.org/10.3390/en11020445

[28] Lee, C., Park, C., and Park, S. 2017. Flow characteristics of steam and gas push in the presence of heat thief zones overlying oil sands deposits. *Applied Sciences* 7(9): 919. https://doi.org/10.3390/app7090919

[27] Choi, J., Park, C., and Jang, I. 2017. Optimisation of well constraints based on wellpad system to accomplish a successive thermal process in a heterogeneous oil-sands reservoir. *International Journal of Oil, Gas, and Coal Technology* 16(1): 27–42. https://doi.org/10.1504/IJOGCT.2017.085997

[26] Kim, J., Kang, J.M., Park, C., Park, Y., Park, J., and Lim, S. 2017. Multi-objective history matching with a proxy model for the characterization of the production performances at the shale gas reservoir. *Energies* 10(4): 579. https://doi.org/10.3390/en10040579

[25] Min, B., Kang, J.M., Lee, H., Jo, S., Park, C., and Jang, I. 2016. Development of a robust multi-objective history matching for reliable well-based production forecasts. *Energy Exploration and Exploitation* 34(6): 795–809. https://doi.org/10.1177/0144598716665008

[24] Jun, J., Kang, J.M., Jang, I., and Park, C. 2015. Hydraulic-unit-based fuzzy model to predict permeability from well logs and core data of a multi-layer sandstone reservoir in Ulleung Basin, South Korea. *Energy Exploration and Exploitation* 33(4): 533–554. https://doi.org/10.1260/0144-5987.33.4.533

[23] Min, B., Park, C., Jang, I., Kang, J.M., and Chung, S. 2015. Development of Pareto-based evolutionary model integrated with dynamic goal programming and successive linear objective reduction. *Applied Soft Computing* 35: 75–112. https://doi.org/10.1016/j.asoc.2015.06.007

[22] Park, C., Yoo, J., Kang, J.M., Jang, I., Lee, C., and Choi, J. 2014. Reservoir heterogeneity affecting steam communication between multiple well-pairs for steam assisted gravity drainage. *Energy Exploration and Exploitation* 32(6): 891–903. https://doi.org/10.1260/0144-5987.32.6.891

[21] Min, B., Kang, J.M., Chung, S., Park, C., and Jang, I. 2014. Pareto-based multi-objective history matching with respect to individual production performance in a heterogeneous reservoir. *Journal of Petroleum Science and Engineering* 122: 551–566. https://doi.org/10.1016/j.petrol.2014.08.023

[20] Kim, H., Park, C., Min, B., Chung, S., and Kang, J.M. 2014. Multiphase flow simulation for in situ combustion to

investigate field-scale hydraulic heterogeneity and air injection rate affecting oil production. *Energy Sources, Part A* 36(21): 2328–2337. https://doi.org/10.1080/15567036.2011.567238

[19] Kam, D., Park, C., Min, B., and Kang, J.M. 2013. An optimal operation strategy of injection pressures in solvent-aided thermal recovery for viscous oil in sedimentary reservoirs. *Petroleum Science and Technology* 31(22): 2378–2387. https://doi.org/10.1080/10916466.2011.569816

[18] Nam, S., Park, C., and Yoo, J. 2013. Uncertainty quantification of an asset evaluation for an oilfield property incorporating response-surface Monte-carlo simulation with stochastic oil price models. *Energy Exploration and Exploitation* 31(5): 783–795. https://doi.org/10.1260/0144-5987.31.5.783

[17] Lee, H., Al-Sarkhi, A., Pereyra, E., Sarica, C., Park, C., Kang, J.M., and Choi, J. 2013. Hydrodynamics model for gas-liquid stratified flows in horizontal pipes using minimum dissipated energy concept. *Journal of Petroleum Science and Engineering* 108: 336–341. https://doi.org/10.1016/j.petrol.2013.06.001

[16] Park, C., Kang, J.M., and Min, B. 2013. Compound real options incorporated with stochastic approach for evaluating an uncertainty in petroleum exploration. *Energy Sources, Part B* 8(3): 252–262. https://doi.org/10.1080/15567240903117617

[15] Jeong, C., Park, C., and Kang, J.M. 2013. A fuzzy model integrated with electrofacies characterization for permeability prediction. *Energy Sources, Part A* 35(1): 66–76. https://doi.org/10.1080/15567030903515021

[14] Choi, J., Pereyra, E., Sarica, C., Park, C., and Kang, J.M. 2012. An efficient Drift-flux closure relationship to estimate liquid holdups for gas-liquid two-phase flow in pipes. *Energies* 5(12): 5294–5306. https://doi.org/10.3390/en5125294

[13] Ahn, T., Park, C., Lee, J.H., Kang, J.M., and Nguyen, T.H. 2012. Experimental characterization of production behavior accompanying the hydrate reformation in methane hydrate bearing sediments. *Journal of Canadian Petroleum Technology* 51(1): 14–19. (SPE 136737) https://doi.org/10.2118/136737-PA

[12] Min, B., Park, C., Kang, J.M., Park, H.J., and Jang, I. 2011. Optimal well-placement based on artificial neural network incorporating the productivity potential. *Energy Sources, Part A* 33(18): 1726–1738. https://doi.org/10.1080/15567030903468569

[11] Ahn, T., Lee, J., Park, C., Kang, J.M., and Lee, H. 2011. Effect of hot-brine temperature on hydrate dissociation behavior in methane hydrate-bearing sediments. *Geosystem Engineering* 14(3): 115–120. https://doi.org/10.1080/12269328.2011.10541339

[10] Han, Y., Park, C., and Kang, J.M. 2011. Prediction of nonlinear production performance in waterflooding project using a multi-objective evolutionary algorithm. *Energy Exploration and Exploitation* 29(2): 129–142. https://doi.org/10.1260/0144-5987.29.2.129

[9] Huh, S., Park, C., Kang, J.M., and Kim, S. 2010. The economic optimization of continuous gas lift system considered lift and cycle efficiency in a mature oil field. *Energy Sources, Part A* 32(17): 1614–1624. https://doi.org/10.1080/15567030902842228

[8] Ahn, T., Kang, J.M., Lee, J., and Park, C. 2010. Experimental investigation of methane hydrate reformation under dissociation process. *International Journal of Offshore and Polar Engineering* 20(1): 68–71.

[7] Park, C., Kang, J.M., and Ahn, T. 2009. A stochastic approach for integrating market and technical uncertainties in economic evaluations of petroleum development. *Petroleum Science* 6(3): 319–326. https://doi.org/10.1007/s12182-009-0051-7

[6] Park, C. and Kang, J.M. 2009. Numerical investigation of chemist flooding in 3D naturally fractured medium. *Energy Sources, Part A* 31(12): 1038–1046. https://doi.org/10.1080/1556703081909524

[5] Park, C. and Kang, J.M. 2008. The effects of hydraulic heterogeneity on tracer transport in 3D fractured reservoir. *Energy*

Sources, Part A 30(20): 1835–1848. https://doi.org/10.1080/15567030701272171

[4] Jang, I., Kang, J.M., and Park, C. 2008. Inverse fracture model integrating fracture statistics and well-testing data. *Energy Sources, Part A* 30(18): 1677–1688. https://doi.org/10.1080/15567030802087510

[3] Park, C. and Kang, J.M. 2008. Characterization of tracer transport in heterogeneous fractured reservoir by a streamline approach on unstructured grids. *Energy Sources, Part A* 30(9): 856–871. https://doi.org/10.1080/15567030600817894

[2] Park, C., Noh, J., Jang, I., and Kang, J.M. 2007. A new automated scheme of quadrilateral mesh generation for randomly distributed line constraints. *Computer Aided Design* 39(4): 258–267. https://doi.org/10.1016/j.cad.2006.12.002

[1] Park, C., Kang, J.M., Jang, I., and Choe, J. 2006. Numerical analysis of diffusion in discrete fracture networks with fractal geometry by using pressure transient data. *Energy Sources, Part A* 28(2): 187–198. https://doi.org/10.1080/009083190889924

PEER–REVIEWED JOURNALS (written in Korean)

[13] Oh, H., Ki, S., Park, C., Jang, I. 2021. Analysis of uncertainty trend for estimated ultimate recovery prediction of shale gas with various production periods based on machine learning. *Journal of the Korean Society for Mineral and Energy Resources Engineers* 58(5): 475–490. https://doi.org/10.32390/ksmer.2021.58.5.475

[12] Kim, J., Kang, J.M., Park, C., Ahn, S., and Min, B. 2017. History matching of gas production rates integrated an artificial neural network with distance-based candidate selection. *Journal of the Korean Society for Mineral and Energy Resources* 54(4): 416–428. https://doi.org/10.12972/ksmer.2017.54.4.416

[11] Park, C. 2015. Outlook and case studies of CO2-enhanced oil recovery. *Petroleum Journal* 31: 202–229.

[10] Nam, S., Park, C., and Jung, S. 2013. Research trends of cross-flow behaviors and production characteristics in a multi-layered reservoir. *Journal of the Korean Society for Mineral and Energy Resources* 50(2): 306–317.

[9] Park, C. and Jung, S. 2012. Research review of flow modeling based on 3D discrete fracture networks. *Journal of the Korean Society for Geosystem Engineering* 49(2): 186–194.

[8] Nam, S. and Park, C. 2012. Research review of carbon dioxide storage in underground geological formations. *Journal of the Korean Society for Geosystem Engineering* 49(2): 195–209.

[7] Yoo, J., Park, C., and Kim, H. 2011. Utilization of nanotechnology in enhanced oil recovery. *Journal of the Korean Society for Geosystem Engineering* 48(6): 794–801.

[6] Han, Y., Park, C., and Kang, J.M. 2010. Multi-objective history matching for estimating the individualized performance of multiple production wells. *Journal of the Korean Society for Geosystem Engineering* 47(5): 660–667.

[5] Kim, J., Park, C., and Kang, J.M. 2010. Upscaling a heterogeneous reservoir using a streamline-based mesh generation incorporated with multi-point flux approximation. *Journal of the Korean Society for Geosystem Engineering* 47(2): 168–176.

[4] Kam, D., Min, B., Chung, S., Park, C., Kang, J.M., Kim, J., Jang, I., and Choi, Y. 2009. Optimization of steam injection pressure in SAGD using artificial neural network. *Journal of the Korean Society for Geosystem Engineering* 46(2): 143–150.

[3] Park, C., Kang, J.M., and Lee, H. 2009. Determination of optimum working interest based on mean-reverting oil-price forecast and Monte Carlo approach. *Journal of the Korean Society for Geosystem Engineering* 46(1): 61–71.

[2] Park, C. and Kang, J.M. 2005. Anomalous transport in 3D heterogeneous fractured reservoir using a streamline approach on unstructured grids. *Journal of the Korean Society for Geosystem Engineering* 42(3): 143–151.

[1] Park, C., Jang I.S., Kang, J.M., and Choe, J. 2003. Pressure transient analysis in fracture media with multi-fractal characteristics. *Journal of the Korean Society for Geosystem Engineering* 40(3): 176–183.

INTERNATIONAL CONFERENCE

[30] Ahn, T., Kim, D.H., Lee, J., and Park, C. 2023. A study on the change of phase distribution in a rock sample during hydrate formation and dissociation based on NMR analysis. In: *10th International Conference on Gas Hydrate (ICGH10)*, 9 –14 July, Singapore.

[29] Ahn, T., Seo, Y., Park, C., Lim, H., and Kim, D.H. 2023. Experimental study of CO2/CH4 distribution in shale rock samples during adsorption/desorption reaction by low-field NMR. In: *EGU General Assembly 2023*, 24–28 April, Vienna, Austria (EGU23-4965). https://doi.org/10.5194/egusphere-egu23-4965

[28] Ahn, T., Kim, D.H., Lim, H., Park, C., and Lee, J. 2022. Investigation of phase distribution changes in a hydrate-bearing rock sample during hydrate formation and dissociation process by low-field NMR. *AGU Fall Meeting Abstract*, 12–16 December, Chicago, IL, USA. (#1186804). https://agu.confex.com/agu/fm22/meetingapp.cgi/Paper/1186804

[27] Oh, J., Park, C., and Jo, S. 2022. Surrogate modeling with convolutional neural networks to evaluate CO2 storage under geological uncertainty. In: *Goldschmidt 2022*, 10–15 July, Honolulu, Hawaii, USA. (#11045) https://doi.org/10.46427/gold2022.11045

[26] Oh, J., Park, C., and Ahn, T. 2019. Sensitivity analysis of rock properties for CO2 sequestration into heterogeneous saline aquifers. *AGU Fall Meeting Abstracts*, 9–13 December, San Francisco, USA. (#GC53H-1230). https://ui.adsabs.harvard.edu/abs/2019AGUFMGC53H1230O/abstract

[25] Kim, J., Park, C., Ahn, S., and Jang, I. 2019. Inverse modeling with deep neural network and k-medoids clustering under uncertain geological scenarios. In: *4th EAGE Conference on Petroleum Geostatistics*, 2–6 September, Florence, Italy. https://doi.org/10.3997/2214-4609.201902253

[24] Ahn, T., Lee, J., Lee, J.Y., Kim, S., and Park, C. 2018. Experimental investigation of gas hydrate production behavior by integrated hot–brine injection method. *AGU Fall Meeting Abstracts*, 10–14 December, Washington D.C., USA. (#OS11B-1421).

[23] Lee, K., Kim, J., Kang, B., Park, C., Shin, H., and Choe, J. 2018. Efficient uncertainty quantification of reservoir productions by stacked autoencoder-based clustering. *Proc. of 19th International Association for Mathematical Geosciences Annual Conference (IAMG 2018)*, 2–8 September, Olomouc, Czech Republic.

[22] Kim, J., Park, C., Kang, J.M., Park, J., Park, Y., and Lim, S. 2016. Probabilistic estimation of shale gas reserves implementing fast marching method and Monte Carlo simulation. *Proc. of the ASME 2016 35th International Conference on Ocean, Offshore and Arctic Engineering (OMAE16)*, 19–24 June, Busan, Korea. https://doi.org/10.1115/OMAE2016-54167

[21] Park, C., Choi, J., Lee, C., Ahn, T., and Jang, I.S. 2015. Operation constraints of steam assisted gravity drainage considering steam interference to accomplish optimum bitumen recovery. *Proc. of the 2015 International Offshore and Polar Engineering Conference (ISOPE 2015)*, June 21–26, Kona, Big Island, Hawaii, USA.

[20] Yoo, J., Park, C., Lee, C., and Choi, J. 2014. Steam communication of well pad system under steam assisted gravity drainage in a heterogeneous oil-sands reservoir. *Proc. of the 2014 International Offshore and Polar Engineering Conference (ISOPE 2014)*, 15–20 June, Busan, Korea.

[19] Chung, S., Park, C., and Kang, J.M. 2013. Sensitivity analysis on steam and gas push to reduce heat loss into the top water-bearing area overlaying oil sands. *Proc. of the 2013 International Offshore and Polar Engineering Conference (ISOPE 2013)*, 30 June – 5 July, Anchorage, USA.

[18] Jeong, S., Chung, S., Min, B., Park, C., and Kang, J.M. 2013. Optimal operation of Fast-SAGD process considering steam channeling among vapor chambers. *Proc. of the 2013 International Offshore and Polar Engineering Conference (ISOPE*

2013), 30 June – 5 July, Anchorage, USA.

[17] Min, B., Park, C., Jang, I.S., Lee, H.Y., Chung, S., and Kang, J.M. 2013. Multi-objective history matching allowing for scale-difference and the interwell complication. In: *75th EAGE/EUROPEC Conference & Exhibition (London 2013)*, 10–13 June, London, UK. https://doi.org/10.3997/2214-4609.20130172

[16] Ahn, T., Lee, J.H., Park, C., and Jang, I.S. 2012. Experimental analysis on effective factors affecting carbon dioxide storage as hydrate in a consolidated sedimentary rock. In: *AGU Fall Meeting*, 3–7 December, San Francisco, USA.

[15] Ahn, T., Lee, J.H., Lee, J.Y., Kim, S.J., and Park, C. 2012. Experimental investigation into the applicability of depressurization to dissociate methane hydrate in an unconsolidated sedimentary sample. *Proc. of the 22nd International Offshore and Polar Engineering Conference and Exhibition (ISOPE 2012)*, 17–22 June, Rhodes, Greece.

[14] Kam, D., Park, C., Kang, J.M., Min, B., and Chung, S. 2011. Injection strategy of solvent-aided thermal process for optimal bitumen production in oil sand reservoirs. In: *73rd EAGE /EUROPEC Conference & Exhibition (Vienna 2011)*, 23–26 May, Vienna, Austria. https://doi.org/10.3997/2214-4609.20149453

[13] Chung, S., Min, B., Park, C., Kang, J.M., and Kam, D. 2011. Operation strategy of steam and gas push in the presence of top water thief zone. In: *73rd EAGE /EUROPEC Conference & Exhibition (Vienna 2011)*, 23–26 May, Vienna, Austria. https://doi.org/10.3997/2214-4609.20149539

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