battery management system (BMS) for grid-scale applications. *Proceedings of the IEEE*, *102*(6), 1014-1030.

[2] Awasthi, A., Karthikeyan, V., Das, V., Rajasekar, S., & Singh, A. K. (2017). Energy Storage Systems in Solar-Wind Hybrid Renewable Systems. In Smart Energy Grid Design for Island Countries (pp. 189-222). Springer, Cham.

[3] Farrokhabadi, M., König, S., Cañizares, C. A., Bhattacharya, K., & Leibfried, T. (2017). Battery energy storage system models for microgrid stability analysis and dynamic simulation. IEEE Transactions on Power Systems, 33(2), 2301-2312.

[4] Faisal, M., Hannan, M. A., Ker, P. J., Hussain, A., Mansor, M. B., & Blaabjerg, F. (2018). Review of energy storage system technologies in microgrid applications: Issues and challenges. Ieee Access, 6, 35143-35164.

[5] Alharbi, H. (2015). Optimal Planning and Scheduling of Battery Energy Storage Systems for Isolated Microgrids (Master's thesis, University of Waterloo).

[6] Divya, K. C., & Østergaard, J. (2009). Battery energy storage technology for power systems—An overview. Electric power systems research, 79(4), 511-520.

[7] Sarasua, A. E., Molina, M. G., & Mercado, P. E. (2013). Dynamic modelling of advanced battery energy storage system for grid-tied ac microgrid applications. Energy Storage-Technologies and Applications.

[8] Naeinian, B. (2016). Seamless Operation of a Microgrid Using BESS.

[9] Rivera-Barrera, J. P., Muñoz-Galeano, N., & Sarmiento-Maldonado, H. O. (2017). SoC estimation for lithium-ion batteries: Review and future challenges. Electronics, 6(4), 102.

[10] Zubi, G., Dufo-López, R., Carvalho, M., & Pasaoglu, G. (2018). The lithium-ion battery: State of the art and future perspectives. Renewable and Sustainable Energy Reviews, 89, 292-308.

[11] Zhang, R., Xia, B., Li, B., Cao, L., Lai, Y., Zheng, W., ... & Wang, W. (2018). State of the art of lithium-ion battery soc estimation for electrical vehicles. Energies, 11(7), 1820.

[12] Meng, J., Luo, G., Ricco, M., Swierczynski, M., Stroe, D. I., & Teodorescu, R. (2018). Overview of lithium-ion battery modeling methods for state-of-charge estimation in electrical vehicles. Applied Sciences, 8(5), 659.

[13] Mathew, M., Mastali, M., Catton, J., Samadani, E., Janhunen, S., & Fowler, M. (2018). Development of an electro-thermal model for electric vehicles using a design of experiments approach. Batteries, 4(2), 29.

[14] Borase, P. B., & Akolkar, S. M. (2017, August). Energy management system for microgrid with power quality improvement. In 2017 International conference on Microelectronic Devices, Circuits and Systems (ICMDCS) (pp. 1-6). IEEE.

[15] Gunasekaran, M., Mohamed Ismail, H., Chokkalingam, B., Mihet-Popa, L., & Padmanaban, S. (2018). Energy management strategy for rural communities' DC micro grid power system structure with maximum penetration of renewable energy sources. Applied Sciences, 8(4), 585.

[16] Hernández, A. C. L. (2017). Energy Management Systems for Microgrids Equipped with Renewable Energy Sources and Battery Units (Doctoral dissertation, Aalborg Universitetsforlag).

[17] Tsang, K. M., Chan, W. L., Wong, Y. K., & Sun, L. (2010, August). Lithium-ion battery models for computer simulation. In 2010 IEEE International Conference on Automation and Logistics (pp. 98-102). IEEE.

[18] Hu, X., Li, S., & Peng, H. (2012). A comparative study of equivalent circuit models for Li-ion batteries. Journal of Power Sources, 198, 359-367.

[19] Dey, S., Ayalew, B., & Pisu, P. (2014, December). Adaptive observer design for a Li-ion cell based on coupled electrochemical-thermal model. In ASME 2014 Dynamic Systems and Control Conference. American Society of Mechanical Engineers Digital Collection.

[20] Moura, S. J., Krstic, M., & Chaturvedi, N. A. (2013, September). Adaptive PDE observer for battery SOC/SOH estimation. In ASME 2012 5th Annual Dynamic Systems and Control Conference joint with the JSME 2012 11th Motion and Vibration Conference (pp. 101-110). American Society of Mechanical Engineers Digital Collection.

[21] He, H., Xiong, R., & Fan, J. (2011). Evaluation of lithium-ion battery equivalent circuit models for state of charge estimation by an experimental approach. energies, 4(4), 582-598.

[22] Wu, B., & Chen, B. (2014, September). Study the performance of battery models for hybrid electric vehicles. In 2014 IEEE/ASME 10th International Conference on Mechatronic and Embedded Systems and Applications (MESA) (pp. 1-6). IEEE.

[23] Raël, S., Urbain, M., & Renaudineau, H. (2014, June). A mathematical lithium-ion battery model implemented in an electrical engineering simulation software.

In 2014 IEEE 23rd International Symposium on Industrial Electronics (ISIE) (pp. 1760-1765). IEEE.

[24] Feng, J., He, Y. L., & Wang, G. F. (2013). Comparison study of equivalent circuit model of Li-Ion battery for electrical vehicles. Res. J. Appl. Sci. Eng. Technol, 6, 3756-3759.

[25] Fang, J., Qiu, L., & Li, X. (2017). Comparative study of Thevenin model and GNL simplified model based on kalman filter in SOC estimation. International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume, 6.

[26] Chen, B., Ma, H., Fang, H., Fan, H., Luo, K., & Fan, B. (2014, August). An approach for state of charge estimation of Li-ion battery based on Thevenin equivalent circuit model. In 2014 Prognostics and System Health Management Conference (PHM-2014 Hunan) (pp. 647-652). IEEE.

[27] Xiong, R., Cao, J., Yu, Q., He, H., & Sun, F. (2017). Critical review on the battery state of charge estimation methods for electric vehicles. Ieee Access, 6, 1832-1843.

[28] Ren, H., Zhao, Y., Chen, S., & Wang, T. (2019). Design and implementation of a battery management system with active charge balance based on the SOC and SOH online estimation. Energy, 166, 908-917.

[29] Coleman, M., Lee, C. K., Zhu, C., & Hurley, W. G. (2007). State-of-charge determination from EMF voltage estimation: Using impedance, terminal voltage, and current for lead-acid and lithium-ion batteries. IEEE Transactions on industrial electronics, 54(5), 2550-2557.

[30] Dey, S., Ayalew, B., & Pisu, P. (2015). Nonlinear robust observers for state-of-charge estimation of lithium-ion cells based on a reduced electrochemical model. IEEE Transactions on Control Systems Technology, 23(5), 1935-1942.

[31] Xie, B., Liu, Y., Ji, Y., & Wang, J. (2018). Two-stage battery energy storage system (bess) in ac microgrids with balanced state-of-charge and guaranteed small-signal stability. Energies, 11(2), 322.

[32] He, H., Xiong, R., Zhang, X., Sun, F., & Fan, J. (2011). State-of-charge estimation of the lithium-ion battery using an adaptive extended Kalman filter based on an improved Thevenin model. IEEE Transactions on vehicular technology, 60(4), 1461-1469.

[33] Chang, W. Y. (2013). The state of charge estimating methods for battery: A review. ISRN Applied Mathematics, 2013.

[34] Barai, A., Widanage, W. D., Marco, J., McGordon, A., & Jennings, P. (2015). A study of the open circuit voltage characterization technique and hysteresis assessment of lithium-ion cells. Journal of Power Sources, 295, 99-107.

[35] Lee, S., Kim, J., Lee, J., & Cho, B. H. (2008). State-of-charge and capacity estimation of lithium-ion battery using a new open-circuit voltage versus state-of-charge. Journal of power sources, 185(2), 1367-1373.

[36] Cheng, Z., Wang, L., Liu, J., & Lv, J. (2016). Estimation of state of charge of lithium-ion battery based on photovoltaic generation energy storage system. Tehnički vjesnik, 23(3), 695-700.

[37] Weng, C., Sun, J., & Peng, H. (2014, March). An open-circuit-voltage model of lithium-ion batteries for effective incremental capacity analysis. In ASME 2013 dynamic systems and control conference. American Society of Mechanical Engineers Digital Collection.

[38] Ma, Y., Zhou, X., Li, B., & Chen, H. (2016). Fractional modeling and SOC estimation of lithium-ion battery. IEEE/CAA Journal of Automatica Sinica, 3(3), 281-287.

[39] Ng, K. S., Moo, C. S., Chen, Y. P., & Hsieh, Y. C. (2009). Enhanced coulomb counting method for estimating state-of-charge and state-of-health of lithium-ion batteries. Applied energy, 86(9), 1506-1511.

[40] Hansen, T., & Wang, C. J. (2005). Support vector based battery state of charge estimator. Journal of Power Sources, 141(2), 351-358

[41] Tudoroiu, R. E., Zaheeruddin, M., Radu, S. M., & Tudoroiu, N. (2018). Real-Time Implementation of an Extended Kalman Filter and a PI Observer for State Estimation of Rechargeable Li-Ion Batteries in Hybrid Electric Vehicle Applications—A Case Study. Batteries, 4(2), 19.

[42] Linghu, J., Kang, L., Liu, M., Jin, W., & Rao, H. (2018, November). State of charge estimation for ternary battery in electric vehicles using spherical simplex-radial cubature kalman filter. In 2018 International Conference on Power System Technology (POWERCON) (pp. 1586-1592). IEEE.

[43] Wu, T. H., & Moo, C. S. (2017). State-of-charge estimation with state-of-health calibration for lithium-ion batteries. Energies, 10(7), 987.

[44] Li, Y., Zou, C., Berecibar, M., Nanini-Maury, E., Chan, J. C. W., van den Bossche, P., ... & Omar, N. (2018). Random forest regression for online capacity estimation of lithium-ion batteries. Applied energy, 232, 197-210.

[45] He, W., Williard, N., Chen, C., & Pecht, M. (2014). State of charge estimation for Li-ion batteries using neural network modeling and unscented Kalman filter-based error cancellation. International Journal of Electrical Power & Energy Systems, 62, 783-791.

[46] Yan, Q., & Wang, Y. (2017, July). Predicting for power battery SOC based on neural network. In 2017 36th Chinese Control Conference (CCC) (pp. 4140-4143). IEEE.

[47] Yu, D. X., & Gao, Y. X. (2013). SOC estimation of Lithium-ion battery based on Kalman filter algorithm. In Applied Mechanics and Materials (Vol. 347, pp. 1852-1855). Trans Tech Publications.

[48] Tingting, D., Jun, L., Fuquan, Z., Yi, Y., & Qiqian, J. (2011, May). Analysis on the influence of measurement error on state of charge estimation of LiFePO4 power Battery. In 2011 International Conference on Materials for Renewable Energy & Environment (Vol. 1, pp. 644-649). IEEE.

[49] He, Z., Gao, M., Wang, C., Wang, L., & Liu, Y. (2013). Adaptive state of charge estimation for Li-ion batteries based on an unscented Kalman filter with an enhanced battery model. Energies, 6(8), 4134-4151.

[50] Hussein, A. A. (2014). Kalman filters versus neural networks in battery state-of-charge estimation: A comparative study. International Journal of Modern Nonlinear Theory and Application, 3(05), 199.

[51] Dişçi, F. N., El-Kahlout, Y., & Balıkçı, A. (2017, November). Li-ion battery modeling and SOC estimation using extended Kalman filter. In 2017 10th International Conference on Electrical and Electronics Engineering (ELECO) (pp. 166-169). IEEE.

[52] Huria, T., Ceraolo, M., Gazzarri, J., & Jackey, R. (2013). Simplified extended kalman filter observer for soc estimation of commercial power-oriented lfp lithium battery cells (No. 2013-01-1544). SAE Technical Paper.

[53] Plett, G. L. (2003). Advances in EKF SOC estimation for LiPB HEV battery packs. Consultant to Compact Power, Inc.

[54] Lu, J., Chen, Z., Yang, Y., & Lv, M. (2018). Online estimation of state of power for lithium-ion batteries in electric vehicles using genetic algorithm. IEEE Access, 6, 20868-20880.

[55] He, W., Williard, N., Chen, C., & Pecht, M. (2013). State of charge estimation for electric vehicle batteries using unscented kalman filtering. Microelectronics Reliability, 53(6), 840-847.

[56] Ma, Y., Duan, P., Sun, Y., & Chen, H. (2018). Equalization of lithium-ion battery pack based on fuzzy logic control in electric vehicle. IEEE Transactions on Industrial Electronics, 65(8), 6762-6771.

[57] Gan, L., Yang, F., Shi, Y. F., & He, H. L. (2017, November). Lithium-ion battery state of function estimation based on fuzzy logic algorithm with associated variables. In IOP Conference Series: Earth and Environmental Science (Vol. 94, No. 1, p. 012133).

[58] Singh, P., & Reisner, D. (2002, October). Fuzzy logic-based state-of-health determination of lead acid batteries. In 24th Annual International Telecommunications Energy Conference (pp. 583-590). IEEE.

[59] Singh, P., Fennie Jr, C., & Reisner, D. (2004). Fuzzy logic modelling of state-of-charge and available capacity of nickel/metal hydride batteries. Journal of Power Sources, 136(2), 322-333.

[60] Salkind, A. J., Fennie, C., Singh, P., Atwater, T., & Reisner, D. E. (1999). Determination of state-of-charge and state-of-health of batteries by fuzzy logic methodology. Journal of Power sources, 80(1-2), 293-300.

[61] Anton, J. C. A., Nieto, P. J. G., Viejo, C. B., & Vilán, J. A. V. (2013). Support vector machines used to estimate the battery state of charge. IEEE Transactions on power electronics, 28(12), 5919-5926.

[62] Jun, B. I., WANG, Y. X., & ZHAO, X. M. (2017). State of charge estimation for electric vehicle batteries based on a particle filter algorithm. DEStech Transactions on Computer Science and Engineering, (smce).

[63] Li, B., Peng, K., & Li, G. (2018). State-of-charge estimation for lithium-ion battery using the Gauss-Hermite particle filter technique. Journal of Renewable and Sustainable Energy, 10(1), 014105.

[64] Xia, B., Sun, Z., Zhang, R., & Lao, Z. (2017). A cubature particle filter algorithm to estimate the state of the charge of lithium-ion batteries based on a second-order equivalent circuit model. Energies, 10(4), 457.

[65] Xia, B., Sun, Z., Zhang, R., Cui, D., Lao, Z., Wang, W., ... & Wang, M. (2017). A comparative study of three improved algorithms based on particle filter algorithms in soc estimation of lithium ion batteries. Energies, 10(8), 1149.

[66] Farrokhabadi, M., König, S., Cañizares, C. A., Bhattacharya, K., & Leibfried, T. (2017). Battery energy storage system models for microgrid stability analysis and dynamic simulation. IEEE Transactions on Power Systems, 33(2), 2301-2312.

[67] Thale, S. S., Wandhare, R. G., & Agarwal, V. (2014). A novel reconfigurable microgrid architecture with renewable energy sources and storage. IEEE Transactions on Industry Applications, 51(2), 1805-1816.

[68] Farrokhabadi, M., König, S., Cañizares, C. A., Bhattacharya, K., & Leibfried, T. (2017). Battery energy storage system models for microgrid stability analysis and dynamic simulation. IEEE Transactions on Power Systems, 33(2), 2301-2312.

[69] Van den Bossche, P., Omar, N., Al Sakka, M., Samba, A., Gualous, H., & Van Mierlo, J. (2014). The challenge of PHEV battery design and the opportunities of electrothermal modeling. In Lithium-Ion Batteries (pp. 249-271). Elsevier.

[70] Tang, X., Gao, F., Zou, C., Yao, K., Hu, W., & Wik, T. (2019). Load-responsive model switching estimation for state of charge of lithium-ion batteries. Applied energy, 238, 423-434.

[71] Xu, J., Li, S., & Cao, B. (2017). A novel current disturbance estimation method for battery management systems in electric vehicle. Energy Procedia, 105, 2837-2842.

[72] Ciortea, F., Rusu, C., Nemes, M., & Gatea, C. (2017, May). Extended Kalman Filter for state-of-charge estimation in electric vehicles battery packs. In 2017 International Conference on Optimization of Electrical and Electronic Equipment (OPTIM) & 2017 Intl Aegean Conference on Electrical Machines and Power Electronics (ACEMP) (pp. 611-616). IEEE.

[73] Perez, H. E., Siegel, J. B., Lin, X., Stefanopoulou, A. G., Ding, Y., & Castanier, M. P. (2013, September). Parameterization and validation of an integrated electro-thermal cylindrical lfp battery model. In ASME 2012 5th Annual Dynamic Systems and Control Conference joint with the JSME 2012 11th Motion and Vibration Conference (pp. 41-50). American Society of Mechanical Engineers Digital Collection.

[74] Lin, X., Fu, H., Perez, H. E., Siege, J. B., Stefanopoulou, A. G., Ding, Y., & Castanier, M. P. (2013). Parameterization and observability analysis of scalable battery clusters for onboard thermal management. Oil & Gas Science and Technology–Revue d'IFP Energies nouvelles, 68(1), 165-178.

[75] Lin, X., Perez, H. E., Siegel, J. B., Stefanopoulou, A. G., Li, Y., Anderson, R. D., ... & Castanier, M. P. (2012). Online parameterization of lumped thermal dynamics in cylindrical lithium ion batteries for core temperature estimation and health monitoring. IEEE Transactions on Control Systems Technology, 21(5), 1745-1755.

[76] Hannan, M. A., Hoque, M. M., Hussain, A., Yusof, Y., & Ker, P. J. (2018). State-of-the-art and energy management system of lithium-ion batteries in electric vehicle applications: Issues and recommendations. Ieee Access, 6, 19362-19378

[77] Lu, L., Han, X., Li, J., Hua, J., & Ouyang, M. (2013). A review on the key issues for lithium-ion battery management in electric vehicles. Journal of power sources, 226, 272-288.

[78] Liu, H., Wei, Z., He, W., & Zhao, J. (2017). Thermal issues about Li-ion batteries and recent progress in battery thermal management systems: A review. Energy conversion and management, 150, 304-330.

APPENDIX A- Equivalent Circuit Parameters

R_0 (Discgarge)

Tc (°C) / SOC	5	15	25	35	45
0.1	0.0190	0.0136	0.0106	0.0090	0.0084