

Battery and Super Capacitor Fed BLDC Motor Drive for Electrical Vehicle Applications

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Abstract: This paper examines the feasibility and capability of a hybrid energy storage system (HESS), composed of battery and super-capacitor units, through simulation. Extensive use of internal combustion engine (ICE)- based vehicles has contributed to severe adverse impacts on the environment and accelerated depletion of fossil fuel reserves, leading to considerable rise in price of gas over the past two decades. These challenges, plus the low efficiency associated with the conventional drivetrains, have made the automotive industry seriously consider and move towards drivetrain electrification in vehicular systems. In electrified vehicles, the propulsion is fully or partially provided by electric motors, powered by onboard energy storage systems. In an attempt to make up for the limitations of the existing energy storage devices and contribute to vehicle electrification movement, The choice of HESS topology has been made based on simplicity of power and control circuits, cost and performance. The design takes into consideration the required power, the converter losses, limitations of energy storage devices, and quality of the current drawn from battery cells.

Keywords: Super capacitor, Power Converter, Brushless DC Motor, battery

REFERENCES

- [1] Alan. A Parker , Electric Power-Assisted Bicycles Reduce Oil Dependence and Enhance the Mobility of the Elderly electric power assisted bicycle. Presented at 29th Australian Transport Research Forum.
- [2] Don Tuite , "Get the Lowdown on Ultracapacitors", Technology report electronic design online , November 2007. URL: <http://electronicdesign.com/Articles/ArticleID/17465/17465.html>.
- [3] Adrian Schnewly, Bobby Maher, Juergen Auer. "Ultracapacitors, the New Thinking in the Automotive World". Maxwell Technologies Inc.
- [4] Pay, S.; Baghzouz, Y.; , "Effectiveness of battery-supercapacitor combination in electric vehicles," Power Tech Conference Proceedings, 2003 IEEE Bologna , vol.3, no., pp. 6 pp. Vol.3, 23-26 June 2003
- [5] Dixon, J.W.; Ortuzar, M.E.; "Ultracapacitors + DCDC converters in regenerative braking system," Aerospace and Electronic Systems Magazine, IEEE , vol.17, no.8, pp. 16- 21, Aug 2002.
- [6] S. M. Lukic, J. Cao, R. C. Bansal, F. Rodriguez, and A. Emadi, "Energy Storage Systems for Automotive Applications," IEEE transactions on industrial electronics, vol. 55, no. 6, pp. 2258–2267, 2008.
- [7] J. Bauman, M. Kazerani, "A Comparative Study of Fuel-Cell – Battery , Fuel-Cell – Battery –Ultracapacitor Vehicles," IEEE transactions on vehicular technology, vol. 57, no. 2, pp. 760–769, 2008
- [8] B. Singh, A. Verma, A. Chandra and K. Al-Haddad, "Implementation of Solar PV-Battery and Diesel Generator Based Electric Vehicle Charging Station," in IEEE Int. Conf. Power Electronics, Drives and Energy Systems (PEDES), Chennai, India, 2018, pp. 1-6.
- [9] N. Saxena, B. Singh and A. L. Vyas, "Integration of solar photovoltaic with battery to single-phase grid," IET Generation, Transmission & Distribution, vol. 11, no. 8, pp. 2003-2012, 16 2017.
- [10] H. Razmi and H. Doagou-Mojarrad, "Comparative assessment of two different modes multi-objective optimal power management of microgrid: grid-connected and stand-alone," IET Renewable Power Generation, vol. 13, no. 6, pp. 802-815, 2019.

[11] O. Erdinc, N. G. Paterakis, T. D. P. Mendes, A. G. Bakirtzis and J. P. S. Catalão, "Smart Household Operation Considering Bi-Directional EV and ESS Utilization by Real-Time Pricing-Based DR," IEEE Trans. Smart Grid, vol. 6, no. 3, pp. 1281-1291, May 2015.